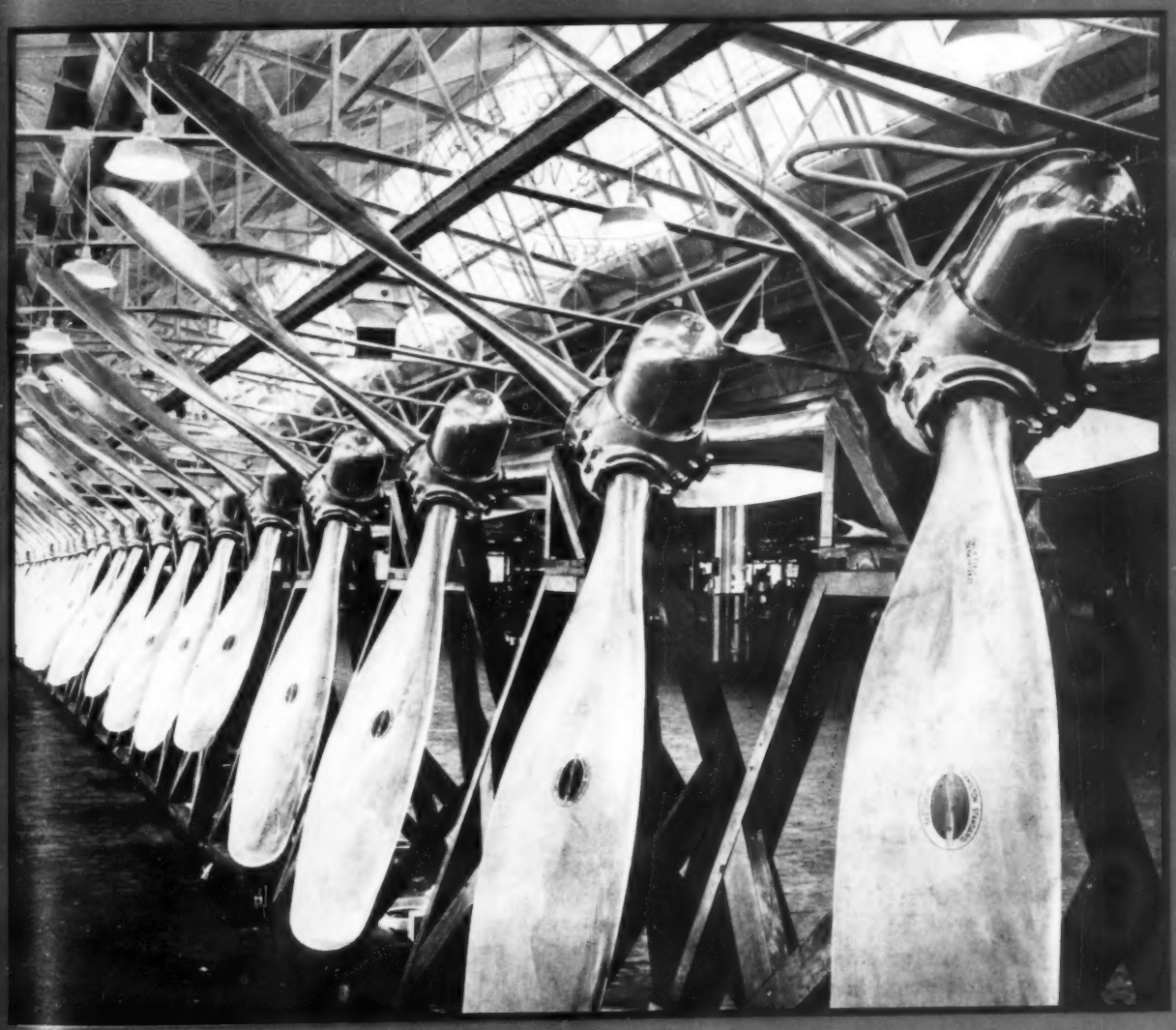
JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION



VOLUME 9 NOVEMBER, 1941 NUMBER 1

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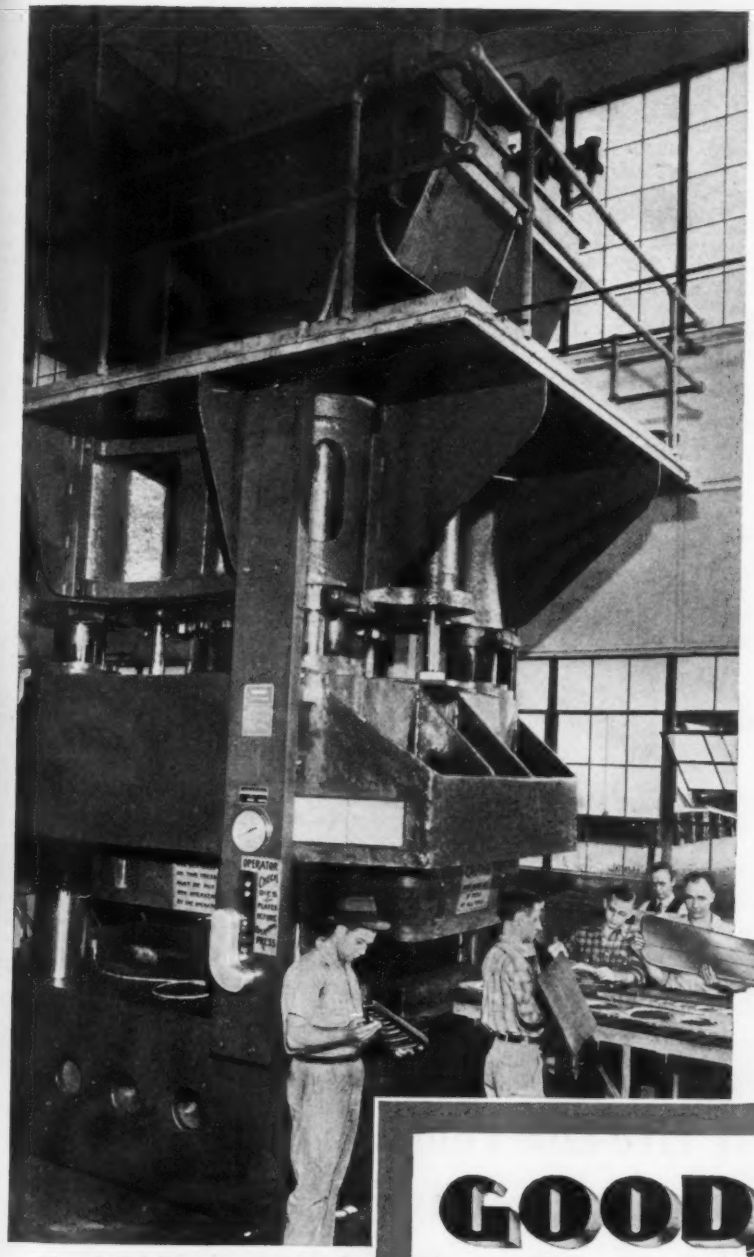

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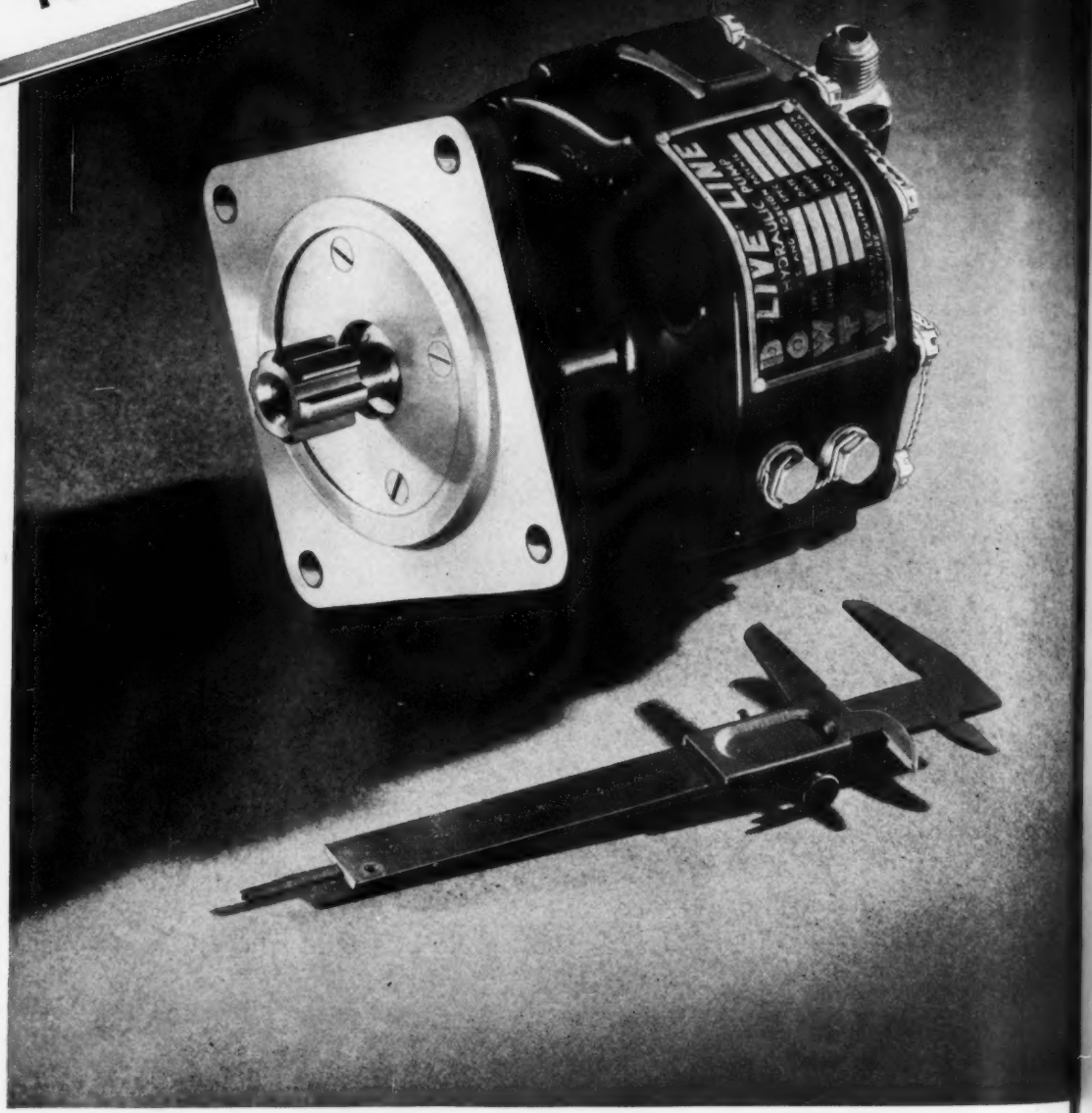

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JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION

NOVEMBER, 1941

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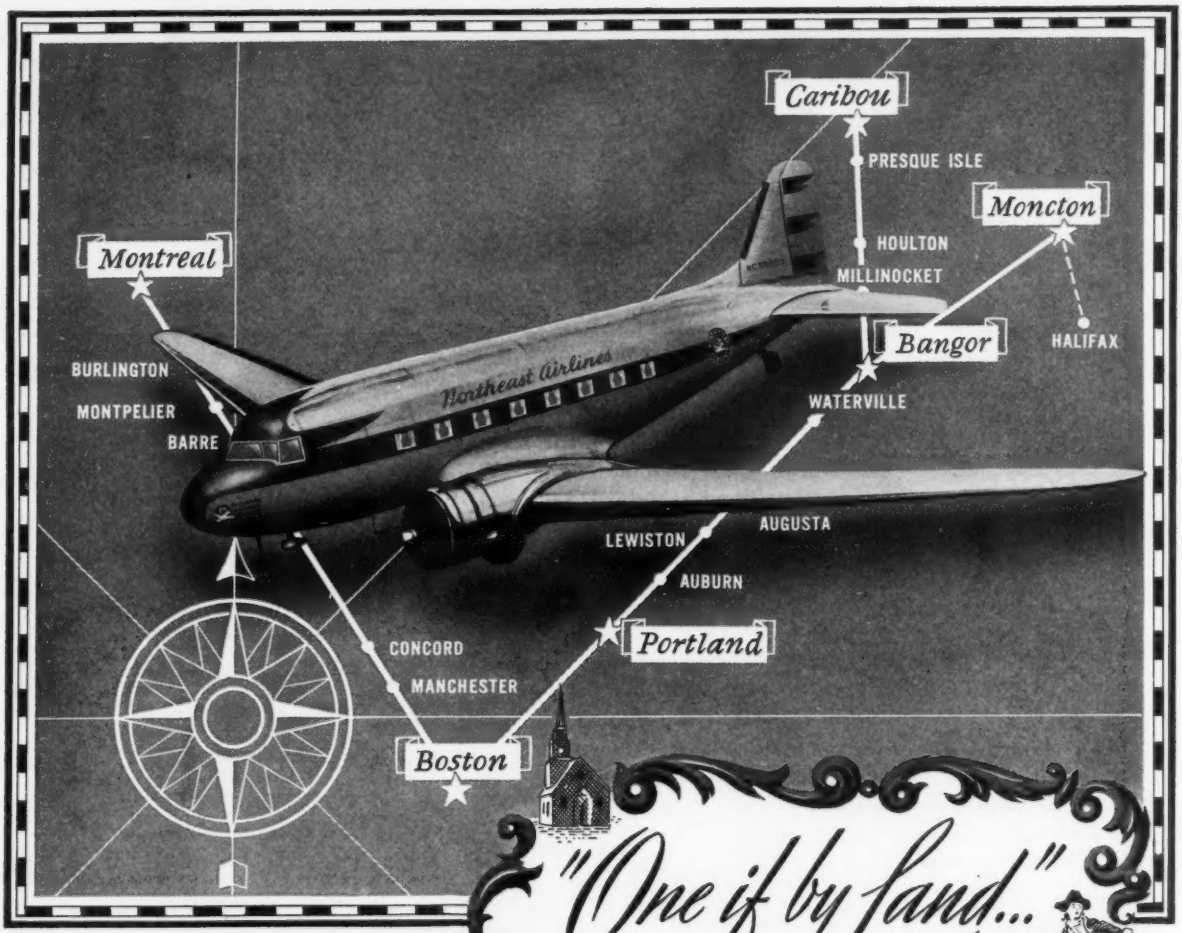

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On the Economy of Time

AS THE PRESSURE OF PRODUCTION for defense becomes more acute, an honest appraisal of current aeronautical publications reveals a marked drop in the proportion of useful, technical information. Two factors seem largely responsible for this thinning out. One is the secrecy which must of necessity veil certain information of military value. The other is the great pressure placed on the time and creative energies of production experts, engineers and research men —those who are the main source of useful, technical information. If, however, the needs of an entire industry and a common aim are to be considered, this dearth of prepared papers and technical articles may prove a false economy of time.

There are few men in aviation today who have not derived, directly or indirectly, a considerable benefit from the work of men or groups who, through the circulation of their research and experimental findings, have made available the results of investigations some of which represent years of independent study. Time taken to prepare a paper or an article on an important experiment or finding saves others in the industry from duplicating the effort and expense and making time-consuming errors.

The real saving in time, then, lies in the widest possible preparation and circulation of such papers and technical articles.

It is unfortunate that during the present emergency those whose experience is most valuable have their noses so firmly to the production grindstone.

However, if the matter of saving time is looked at in projected perspective, it becomes evident that the *real* waste may well lie in the *failure* to spend the time necessary for the preparation and circulation of important advances.

Eight Years of Service

To oldtimers in aeronautics, the suggestion that aviation is something new or recent indicates the opinion of a newcomer. But to everyone even remotely connected with aviation today, there is no argument about the adolescence of this field of achievement in the light of what is yet to come.

The *Aeronautical Review* can be viewed in much the same light. It was conceived eight years ago as a section embodied in the *Journal of the Aeronautical Sciences*. The rapid pyramiding in quantity and importance of published aeronautical material demanded a more thorough and usable coverage of the aeronautical press than was practicable within the confines of the Journal—and so, the Review came into its own as a separate edition.

The hearty response to the service performed by the *Aeronautical Review* for the aeronautical industry has confirmed our belief in its permanently constructive utility to the future of aviation. Just as the aircraft production program is reaching its maturity as a mass-production industry, so is the Review serving as a full-fledged aid to the advancement of aeronautics by making readily available a "what-and-where" index of every step of aviation progress reported—from the initial brain-storm, through research and experiment to the improvement and perfection stage of every advance reported.

News or Pictures?

Occasional queries regarding the editorial viewpoint of the *Aeronautical Review* prompt a few notes here on the policy governing the objectives of the publication. Visual journalism has become part and parcel of modern day life; it is here to stay. But, as with any innovation in the root-growing stage, this facet of the Fourth Estate has suffered much abuse in the process of finding its proper place and testing its limitations and potentialities. Its educational advantages are tremendous, but they have not yet been adequately developed in technical fields where photography's chief forte remains a mechanical aide in engineering and research development.

This publication's technical emphasis is extended to the illustrations presented each month. Only those are used which pertain to reviews printed and contain real information for the technician and student. This policy has the express approval of readers, who say that they don't want the Review "dressed up with photographs that they can see elsewhere." They find men and machines at work the most useful type of illustration. Less stress has been put on photo-illustrative matter for engineering, production and research men than those in other fields.

It would be logical, therefore, to develop a parallel technique in photo-illustration for men of this level in order that the same relative consideration be given to their time. In other words, before the camera's shutter is opened for an engineer's picture, does the scene fit the technical version of the old saw?—will it tell the engineer a 10,000-word story?

News Review

September 11. It was reported that the 50th Transport Wing of the U.S. Army Air Forces would conduct a freight transport service between Sacramento and Ladd Field, Fairbanks, Alaska, to expedite shipment of materials necessary for the proper fortification of Alaska and the construction of defense bases.

September 11. Gen. George Brett of the U.S. Army Air Forces arrived in Cairo to observe the performance of American-built aircraft under operational conditions in the African, Mediterranean, Middle Eastern and Atlantic battle zones.

September 11. The old Ford aircraft plant at Dearborn, Michigan, inoperative for several years, was reported being reconditioned for subassembly production of B-24 bombers.

September 12. The M-170, 70-ton four-engined flying boat built by The Glenn L. Martin Company was shown to the public for the first time.

September 13. The Civil Aeronautics Board granted Pan American Airways authority to establish a commercial airline between Miami and points on the Southwest African coast.

September 13. Universal Moulded Products Corp., Bristol, Virginia, announced that it had acquired the assets of Monocoupe Airplane and Engine Corp. and the Bristol Aircraft Corp., as well as the entire stock of Bristol Aircraft, Ltd., of Canada.

September 14. There was an attendance of 500,000 persons at an air meet at Newark Airport on the occasion of its reopening as an air terminal.

September 15. The Civil Aeronautics Administration consolidated airway traffic control in the area of La Guardia Airport, New York, by putting locally hired tower operators and Federal air traffic employees under joint government direction.

September 15. Pan American Airways announced that it would begin carrying air express across the Atlantic under a system of aircerts similar to the navicerts used by surface vessels.

September 16. Brig. Gen. Frank P. Lahm, the first officer in the world to solo an airplane, was nominated by President Roosevelt for promotion to Major General rank.

September 18. The first tactical movement by parachute troops in the U.S. took place during maneuvers near Clarence, Louisiana.

September 18. The first contingent of U.S.-built fighting aircraft arrived in Russia, accompanied by a small group of American mechanics.

September 18. Army officials witnessed tests on a radio-controlled aerial torpedo designed by John Hodgdon, former professor of engineering with the U.S. Insular Service.

September 19. The U.S. Army announced that the formation and training of air-borne infantry would begin shortly when the first unit of 500 volunteers undergoes training at Fort Benning, Georgia.

September 20. Plans for the establishment of three international and four domestic air lines by the Argentine government were disclosed when the Director General of Aeronautics delivered a draft bill to the Ministry of the Interior providing for the appropriation of $4,000,000 for aircraft, airports and radio equipment. The new lines will operate in competition with existing routes operated by the United States and European countries.

September 21. The Government helium plant at Cliffside, Texas, will be enlarged to raise its annual output to 60,000,000 cu. ft. of the gas. $1,775,000 will be spent on drilling new wells and enlarging facilities.

September 22. Juan T. Trippe, president of Pan American Airways, was awarded The Daniel Guggenheim Medal for his contribution to the development and successful operation of oceanic air transport.

September 25. The Reconstruction Finance Corporation approved an $8,000,000 loan to the Reynolds Metals Company for the construction of an aluminum plant at Lister Kill, Alabama, to provide a capacity of 60,000,000 lbs. annually.

September 26. Pan American Airways Atlantic Clipper made the first night departure to Europe from La Guardia Airport, New York. The first regular transoceanic air express left for Europe the same day.

September 26. The Army Air Forces announced that contracts had been awarded to Aeronca, Piper and Taylorcraft for the first light airplanes ordered for regular duty. The 65-hp. craft will be used for liaison and artillery spotting.

September 30. The Defense Plant Corporation announced that it had arranged a $28,317,000 financing program for the construction of two magnesium plants, one for the Mathieson Alkali Works at Lake Charles, Louisiana, and the other for the International Agricultural Corporation at Austin, Texas. The two plants will have an annual capacity of 60,000,000 lbs.

October 1. Commanders were named for three of the four bomber commands provided for in the establishment of the autonomous Army Air Force. These groups, designed to destroy hostile installations and attack enemy troop concentrations, are to be commanded by Brig. Gen. Arnold N. Krogstad, First Bomber Command, Langley Field, Virginia; Brig. Gen. John B. Brooks, Second Bomber Command, Fort George Wright, Spokane, Washington; and Brig. Gen. Follett Bradley, Third Bomber Command, Drew Field, Tampa, Florida. The Fourth Command, whose chief has not as yet been named, will have headquarters at Tucson, Arizona.

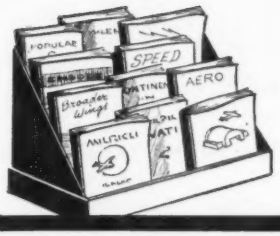
October 2. An agreement was concluded between Pan American Airways and the British Government for service between British West Africa and Anglo-British Sudan. This is the last link in the route across the South Atlantic to be used in ferrying aircraft to the African and Mediterranean war zone.

October 2. Grove Webster, first director of the Civilian Pilot Training Service, resigned to return to private aviation. His successor is Maj. John P. Morris.

October 4. The Civil Aeronautics Board made public the establishment of a fixed and permanent rate structure for Post Office Department contract payments to All-American Aviation, Inc., whose airmail pickup service may by this action be considered a regular Post Office Department facility, having operated on an experimental basis up to now.

October 7. Lieut. Col. Caleb V. Haynes established a point-to-point speed record when he flew from

(Continued on page 58)



Periodicals

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Review or the Institute of the Aeronautical Sciences.

Accessories

Mass Production of Aircraft Clamps. R. R. Harrison. An outline of improved manufacturing methods devised by Bendix Aviation engineers for meeting emergency demands for clamps to electrically bond fuel, oil, hydraulic and electrical conduit and tubing to the airplane structure and cushion it against vibration. The dies, presses and tool machinery developed to handle greater mass production of such clamps are described. *Aviation*, October 1941, pages 84, 169, 7 illus.

AN9534 Type Disconnect Plugs. Part of *Western Flying's* "Technical Section," this item presents notes on the nomenclature and proper call-out for the new electrical and radio disconnect plugs made in conformance with Army-Navy specification 9534. *Western Flying*, September 1941, pages 31, 50, 1 illus.

C.A.A. Approves Plywood Pontoons. A description of the plywood pontoons developed by National Plywoods, Inc., said to forecast the use of waterports by the majority of civilian airplanes in the future. The first Approved Type Certificate for such floats was issued recently by the C.A.A. *Commercial Aviation*, September 1941, pages 52, 98, 1 illus.

Aircraft Heating Equipment. The Vickers Wellington bomber employs an exhaust-heated steam system which is combined with an air circulation system. The features and installation of the system, manufactured by Gallay, Ltd., are described in this article along with manufacturing and testing procedure. *Aircraft Production*, September 1941, pages 395–397, 9 illus.

Aerodynamics

An Engineering Attack Upon Aircraft Flutter. Jean Wilie. Discussion of a method of attacking the problem of flutter in aircraft structures. Experimental evidence indicates that the two-dimensional theory quite closely predicts the critical flutter speed if all parameters are accurately known. The determination and control of flutter parameters is outlined along with flutter analysis method and the engineering application of flutter analyses. The typical use of a theoretical flutter model is explained. *Aviation*, October 1941, pages 62, 63, 160, 162, 7 illus.

General Approach to the Flutter Problem. S. J. Loring. An outline of a general approach to the flutter problem for use in investigating any mode of flutter of any structure provided the air-forces are known. The method can be used to investigate the possibility of flutter on such structures as airplane wings, tail surfaces and bomb doors, aircraft propeller blades, vehicular bridges, buildings, etc.

With a well-known solution for the air-forces for two-dimensional flow over an airfoil with an aileron, equations are derived which can be used to determine the flutter speed for the wing or tail surfaces of any conventional airplane. The use of still-air vibration tests in obtaining the structural friction of structures and in checking a part of the flutter computations experimentally is indicated. To suggest the possibilities in the use of this method, a standardized procedure for its general application to aircraft flutter problems is outlined briefly. *S.A.E. Journal*, August 1941, pages 345, 355, 3 illus.

Fliegen met geluidssnelheid (Flight at Sonic Speed). The first installment of an introductory study of flight at sonic speed. *Vliegwereld*, July 31, 1941, page 415.

Temperature Effects in a Laminar Compressible-Fluid Boundary Layer Along a Flat Plate. H. W. Emmons and J. G. Brainerd. A solution of the two-dimensional boundary-layer problem of the steady laminar flow of a perfect gas along a thin flat insulated plate is presented for a wide range of gas velocities and properties. It is concluded that compressibility and

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Prandtl number do not introduce any new phenomena, but do alter the drag on the plate, the equilibrium temperature of the plate, and the velocity and temperature distribution through the boundary layer.

The drag coefficient for the plate, the temperature of the plate, and typical velocity and temperature distributions are given by equations and graphs. *Journal of Applied Mechanics*, September 1941, pages A105–A110, 10 illus.

On the Statistical Theory of Turbulence. C. L. Pekeris. In the preliminary section a method is given of determining the distribution function of turbulent velocities. The distribution function $P(u)$ of a component turbulent velocity $u(t)$ is defined as the probability that u shall have the value between u and $u + du$. The part $P_e(u)$ of $P(u)$ which is an even function of u can be determined by first measuring the mean with respect to time of $\cos zu(t)$ for all values of z. In a similar fashion, the part $P_o(u)$ of $P(u)$ which is odd in u can be determined by measuring $\varphi(z)$, which is $\overline{\sin [zu(t)]}$, and obtaining the sine transform of $\varphi(z)$.

In a section on A Method of Determining the Auto-Correlation Coefficient of Turbulent Velocities a new method is given of determining the auto-correlation coefficient $R(\tau)$ of $u(t)$. This method depends on the possibility of measuring a function $U(t, \theta)$, which is the mean value of $u(t)$ over an interval of time 2θ. $U(t, \theta)$ has, like $u(t)$, a zero mean value and the mean of its square. $\overline{U^2(t, \theta)}$ is equal to $\overline{u^2(t)}$ at $\theta = 0$ and decreases with θ. If now $r(\theta)$ is defined by $r(\theta) \equiv \overline{U^2(t, \theta)}/\overline{u^2(t)}$ then the auto-correlation coefficient $R(\tau)$ of $u(t)$ is given. *Journal of the Aeronautical Sciences*, October 1941, pages 475–476.

Air Law

Pilot Rating Changes. A summary of the new Civil Air Regulations concerning pilot ratings which are now based on horsepower rather than weight classifications. Types such as airplane, autogiro, glider, and lighter-than-air are retained in the new ratings, as are classifications of single-engine land or sea, multi-engine land or sea, and unconventional. Power ratings cover light airplanes at 80 hp. or less, while on all aircraft above 80 hp., horsepower rating is given within a range of 50 per cent above and 50 per cent below the horsepower of the aircraft for which the pilot is rated. For example a pilot rated on a 220 hp. airplane would hold a rating to fly aircraft from 110 hp. to 330 hp. Should he also have flown a minimum of five hours in light airplanes, his rating would be given as 330 hp. or under. *Yankee Pilot*, September 1941, pages 9, 10.

Air Policy

Do Commercial Schools Face "Liquidation?" A discussion of the position of the dozen or so commercial aviation operators in Canada who have not yet been taken into the Commonwealth Air Training Plan. It is indicated that in view of happenings of recent months Civilian Training Schools are being barely tolerated by the authorities although they have helped the Commonwealth Plan immensely. The aid afforded by these schools is reviewed with a statement of the Government's position to date regarding them. *Commercial Aviation*, September 1941, pages 33, 34, 39, 5 illus.

A Fourth Arm in Hemisphere Defense. Maj. Frank L. Nelson. Discussing German invasion of South America politically and economically, this article considers the possibilities of a physical invasion by German armed forces and finds such a feat neither improbable nor impossible. The observations are made in connection with a cliche which is said to be floating around the Army—to the effect that the United States has four lines of defense: the Army, the Navy, the Air Forces and Pan American Airways. The writer concludes that in the grim emergency that the British Navy should fail to bar German forces from South America the United States would be forced alone to defend that 4,000 miles of vulnerable coast and might be glad indeed to call into action its "fourth line of defense," Pan American Airways. *U.S. Air Service*, August 1941, pages 10–13, 2 illus.

Pilots for the Big Ships Are in Demand. How and where to get pilots for the transoceanic ferry services has become a serious problem to ferry service authorities according to this article which reports the sources for such pilots to date and the possible sources which may be tapped as the shortage becomes more critical. The chief difficulty has been to secure pilots with multi-engine experience. But there is also a shortage of big airplanes with which adequate training may be provided. *American Aviation*, September 15, 1941, page 4.

Our Unused Potentialities for Aeronautical Research and Development. John E. Younger. An address on the occasion of the 1941 award of the *Spirit of St. Louis* Gold Medal. Attention is called to the failure to set aside funds for the training of aeronautical engineers. As a result of this gap in our aeronautical educational and development program, the aviation industry is said to lose in two ways. It fails to acquire sufficient highly developed technical personnel with adequate training and vision for original developments, and it loses a highly efficient and original source of research for the germination of new ideas, methods and principles.

Nearly all our national research in aeronautics, it is said, goes into the development of known principles and methods. On the assumption that the germination of new ideas lies largely with students in the schools and universities, it is urged that such research should be stimulated by the endowment of the various branches of aeronautical science in which new ideas are so much needed. *Mechanical Engineering*, August 1941, pages 575, 576, 1 illus.

The Bomber and Billy Mitchell. Development of the big bomber policy is traced from its beginning in the years of controversy during which it was championed by General Mitchell. Proof of their striking power as shown by the present war has been made the basis for the present policy calling for mass production of high-altitude, long-range heavy bombers, the production program for which has been called the biggest single industrial project ever undertaken. *Fortune*, October 1941, pages 184, 186, 188.

Priorities May Help the Light Plane! E. E. Porterfield, Jr. A light airplane manufacturer discusses the effect of present priority ratings on the light airplane industry. Far from feeling discouraged about restrictions, he believes that substitute materials may be developed to produce better airplanes at a lower cost. He states that Porterfield engineers know that by increasing the empty weight of their trainer only twenty pounds they can eliminate many of the hard-to-get materials heretofore considered important in aircraft construction.

With only 195 pounds of aluminum allowed for each light airplane, and this applies only to aircraft designated for C.P.T.P. training, this metal can be replaced nearly everywhere but in the engine, wheels and cowling. Spruce can be eliminated entirely. Seamless tubing can be replaced with welded tube, and all substitutions made without any sacrifice in speed, strength or performance, and a sacrifice of only twenty pounds in weight. Suggested substitutes are noted along with some of the results of their use. *Air Trails*, September 1941, pages 22, 23, 33, 5 illus.

Aerial Supremacy. Robert P. Patterson. The Undersecretary of War draws the conclusion that military

success has been indicated by recent events to be directly proportional to air superiority. For this reason, he states, this nation is determined to make its aircraft superior to any others in the field. Now that the quality of these airplanes has been proved, the next step is to produce them in great numbers. The undersecretary expresses the belief that national cooperation will solve the problem of production just as it solved the problem of design. *Aero Digest*, October 1941, page 146, 2 illus.

Air Power

The Riddle of Soviet Air Power. An estimate of the condition of Russian air power. It is intimated that Russia has kept the world guessing regarding her air power and that it now appears she may have something worth hiding, in view of the impeded progress of Germany's attempted conquest. A number of sources are quoted in analyzing published data on the subject of Soviet air power, the growth of which is traced from 1934 to 1940.

This article leans to the expansive interpretation of Russian air strength with the comment that even if Soviet aircraft in the main be not as good as those of the Luftwaffe, their pilots are a match for the Germans and "the Soviets, who have been practicing military airmanship for a far longer period than have the Germans, since the last war, have worked out clever strategy and are certainly not lacking in courage." *Commercial Aviation*, August 1941, pages 27–29, 70, 124, 3 illus.

De Japansche luchtmacht (The Japanese Air Force). A survey of the condition of Japan's air power. There is no air force in the world of which so little is known as the Japanese Air Force. However, the war with China has revealed some of its equipment. There is little known of the number of airplanes in actual military service, or of their construction data. However there is a numerical system which makes it possible to identify Japanese military airplanes as to their date of construction. Accordingly, airplanes carrying the number 95 have been manufactured in 1935, for example the pursuit plane 95 and the machines 95-1, 95-2, and 95-3 which derived from it. Airplanes manufactured in 1936 carry the number 96, etc.

Many pursuit and scouting airplanes, light and heavy bombers carry the number 97. As a matter of fact, the first series of the 97 type airplanes may be considered to be modern. The heavy bomber of this series is a four-engined machine with maximum speed of about 420 km. per hour. The maximum bomb load is 1,500 kg. and the maximum cruising range is 3,500 km. However, this cruising range depends on the bomb load. Pursuit plane 97 and scouting plane 97 have a speed of 480 km. per hour and are at present the standard type of the Japanese Air Force.

The modern twin-engined bomber type 98 corresponds to the Fiat BR-20M, and was manufactured under license. In 1938 Japan bought about 80 Italian-built Fiat bombers. The Italian built Fiat BR-20M is powered by two Fiat radial engines delivering a maximum speed of 410 km. per hour. However one may justly assume that the Japanese version is not as fast.

Many Japanese airplanes are copied from American designs, for instance the pursuit airplane type 96 shows great similarity to the Boeing pursuit type. Up to now the Japanese engine industry has not succeeded in producing a 1,000 hp. engine. The main Japanese aircraft factories are: Nakajima in Oetamatsi, Ojima in Oshkobo, and Mitsubishi in Nagoya, Sibaura and Omatsi near Tokio. The Mitsubishi plants also manufacture engines, instruments, and armament.

Japan has large aerodynamic laboratories, such as The Institute of the University of Tokio, the Aerodynamic Institute of the Army, the Institute of the Naval Arsenal, the Laboratory of the Ministry of Transportation, and the Central Aeronautical Research Institute. In the scientific field Japan must be credited with very important contributions. At the present time there are laboratories under construction which will have wind tunnels of enormous dimensions. Japan has 7 aircraft carriers, three of which are brand new. These are the 10,050-ton Soryu, Hiryu, and Syokaku, each able to carry about 30 airplanes.

Commercial aviation in Japan covers a network of 16,813 km., operated by the Dai Nippon Air Line. The transport craft are of various makes and vintages; modern types are used on the main lines only while the older ones do inland service. *Vliegwereld*, July 31, 1941, pages 408, 409, 9 illus.

United States Air Power Is Skyrocketing. A report on the current condition of the American defense effort in the field of aviation. Statistics and other information are given on increases in production and production facilities and in the speed and ceiling of bombers. *Commercial Aviation*, August 1941, pages 33, 34, 39, 40, 54, 9 illus.

The Japanese Air Force. Lynn C. Thomas. An estimate of the quality of Japanese military aircraft and pilots with notes of comparison with those of the United States. The writer's observations are founded on five years spent in the Far East and Pacific islands, seeing Japanese pilots in action over China, discussing the situation with Japanese military leaders and with war correspondents in China and military observers.

Expressing conviction that the Japanese will attempt conquest of the Dutch East Indies despite their knowledge that it means war with the United States and Britain, this writer analyzes Japanese military air tactics, pilots and equipment, describes a typical Japanese air strafing attack, and concludes with the expression of little faith in the efficiency or strength of Japanese air power. *Western Flying*, September 1941, pages 22, 23, 4 illus.

Which Road to Victory. Maj. F. A. de V. Robertson. A consideration of whether air power alone or a formidable number of mechanized divisions supported by a large army air arm should be chosen as the strategic means to ultimate victory of the allies in the present war. Commenting on the futility of sheer bombing power, the writer points out numerous vital targets other than factories, particularly the lines of communication behind a hostile army. This is said to be the work of bombers cooperating with an army rather than the work of an independent air force. *Flight*, July 24, 1941, pages 51, 52, 3 illus.

Free French Air Force. Henry Baerlein. Exploits of French pilots in reaching British territory by devious means following the fall of France are recounted in this description of the French contingent of British air strength. The formation of the Free French Air Force out of dribs and drabs of French recruits who are still making their way to Britain, the training and air war operations of various units, and the background of Colonel Valin, their chief of staff, are reviewed. *Flight*, July 24, 1941, pages 48a–c, 7 illus.

Air Transport

Technical Advances to Insure U.S. Air Transport's Future. Juan Trippe. The president of Pan American Airways cites the problems that will probably face the post-war international air transport companies.

The basic requirement for successful competition with such powerfully implimented companies as British Overseas Airways, Deutsche Lufthansa, Ala Littoria, Air France, Dai Nippon or their successor companies is greater speed to permit practical overnight service to Europe, and to

Hawaii, 24 hour service to Buenos Aires, and 48 hour trips to the Orient, South Africa and India.

To achieve this, the American lines must have greater available horsepower, lower fuel consumption and greater propulsive efficiency. Higher wing-loading and improved high-lift devices must also be perfected. *Aero Digest*, October 1941, pages 316, 317, 392, 1 illus.

Prodigy Airline. A review of the establishment and growth of Yukon Southern Air Transport, Ltd., this article describes the course by which the airline grew to adult stature in four brief years, took civilization into the far northwest and is planning one day to operate into Shanghai, via Alaska and the Behring Straits. *Commercial Aviation*, August 1941, pages 43–45, 60, 10 illus.

Het Huisdier en het Vliegtuig (Domestic Animals and the Airplane). The part that the airplane plays in the transportation of domestic livestock is not generally known. This article gives an account of the shipment of dogs, cats, piglets and chicks between Australia and the Dutch East Indies, as well as the transfer of zoo animals such as koala bears, kangaroos and rare birds. Java imports oysters from Australia as well as fish eggs and young fish to stock its streams. The only animal thus far to be refused by the K.N.I.-L.M. (Royal Dutch East Indies Air Line) was a full-grown tiger. *Luchtvaart*, July 24, 1941, pages 264–266, 3 illus.

Luchtvaart in China (Commercial Aviation in China). A survey of the operations of China National Aviation Corp. and its effort to maintain the important air routes despite the opposition of the Japanese air force. Special effort is made to retain service between such main points as Chunking and Hong Kong, Kunming and Rangoon.

Because of the peculiar operating conditions, no fixed schedules are maintained, the pilots seeking the worst possible flying weather for operations, as the Japanese military pilots usually stayed on the ground at these times. *Vliegwereld*, June 5, 1941, page 288, 3 illus.

Flying the Atlantic. The first of three articles on Pan American Airways operations, this one describes the nature and function of the multiple flight crew and outlines the training of the crew. The series is presented as a general review of Pan American technique as applied to the problems of the North Atlantic Clipper service. *Aviation*, October 1941, pages 48, 49, 184, 186, 4 illus.

Airplane Description

Curtiss Military Aircraft. Descriptions of the various types of military airplanes in current production at divisions of the Curtiss-Wright Corporation. The types described include the P40 series single-seater pursuit; the O52, a high wing observation airplane; the SO3C-1 mid-wing scout bomber; the SB2C-1 dive-bomber; the SNC-1 combat trainer and the twin-engined C-46 transport. Photographs of currently produced Whirlwind and Cyclone engines and Curtiss propellers and some of the aircraft in which they are being used are also given. *Aero Digest*, October 1941, pages 228, 231, 233, 235, 236, 92 illus.

Dornier Do.22. Description, specifications and performance figures on the Dornier Do.22, a single-engined, high-wing twin-float monoplane built for long-range reconnaissance, light bombing or torpedo carriage. *Aeronautica*, July 1941, pages 8, 9, 3 illus.

Aviation Sketch Book. Cross-section and cutaway drawings with explanatory captions showing details of the Kinner R-53 engine, the wing of the Meyers OTW trainer, the engine installation and landing gear of the Bristol Beaufighter, the general structure and a wing gun bay of the Rolls-Royce-powered Hawker Hurricane, the horizontal stabilizer and control surface nose section of the Messerschmitt 110, and the fuselage and flap of the Beechcraft D-17. *Aviation*, October 1941, pages 92, 93, 95, 9 illus.

Messerschmitt Menace. A description of the design and characteristics of the new Messerschmitt Me 109F. Built for increased performance at high altitudes, the airplane is armed with a Mauser cannon capable of a fire of 900 rounds per minute. Among specifications mentioned are maximum speed, 380 m.p.h. at 21,000 ft., and service ceiling, which is reported as 40,000 ft. *Aviation*, October 1941, pages 50, 51, 5 illus.

"Beaufighter." Description of the Bristol "Beaufighter," the interceptor conversion of the Beaufort, a low-wing, twin-engined craft, equipped with six machine guns and for 20 mm. Hispano-Suiza cannon. *Air Forces Review*, September 1941, pages 8, 9, 3 illus.

Beaufort—A Versatile Weapon. A general description of the design and construction of the Bristol Beaufort high-performance twin-engined mid-wing monoplane, designed to carry out the duties of combined bomber, general reconnaissance, torpedo bomber and general purpose landplane. No specifications are given. *Canadian Aviation*, August 1941, pages 29, 32, 3 illus.

American Bombers and Flying Boats. Descriptions of eight types of aircraft being built in the United States for Britain. Some figures are given on performance and specifications. Aircraft noted are the Lockheed Hudson (EB-14), Douglas Boston (DB-7), Martin Maryland (167-W), Martin B-26, Boeing Flying Fortress (B-17), Consolidated Liberator (B-24), Consolidated Catalina (Model 28) and Consolidated 31. *Flight*, July 24, 1941, page 49.

U.S. Dive Bombers of R.A.F. Brief descriptions of the Curtiss Cleveland (Helldiver-77), Vought-Sikorsky Chesapeake (VS-156), Brewster Bermuda (Model 138) and Northrop A17-A. Some specification and performance figures are given. *Flight*, July 17, 1941, page 34g, 1 illus.

Savoia-Marchetti. Descriptions, structural details, specifications and performance data on some of the late types of low-wing trimotors built by Savoia-Marchetti. The SM 84, 82 and 75 are the types presented in their bomber, seaplane and transport conversions. A brief history of the company which was founded in 1915 is also given. *Flygning*, August 1941, pages 8,9, 5 illus.

Flying the New Fleet "Fort." A compilation of the impressions of various pilots who have flown the Fleet 60, new Canadian-designed intermediate trainer now ready for production-delivery to the R.C.A.F. The description of the airplane as given in this article includes an account of the cooling system and of the unusual oil warm-up system. Weights, loadings and performance are noted. *Canadian Aviation*, September 1941, pages 22, 23, 4 illus.

New Combat Trainer Used by U.S. Navy. The Curtiss-Wright SNC-1 advanced combat trainer is described. The airplane was designed specifically for the training of combat pilots during the period directly preceding their transfer to fighting aircraft, and resembles closely the appearance of a modern fighter airplane but is smaller in size. Structural features are noted. No specifications are given. *Canadian Aviation*, August 1941, pages 30, 32, 3 illus. Also *Air Forces Review*, September 1941, page 20, 2 illus., and *Commercial Aviation*, August 1941, pages 48, 52, 2 illus.

The Curtiss "Kittyhawk." A brief description of the newest version of the Curtiss P-40 line of fighters. Chief improvements are substantially better performance, greater speed and

more fire power. *Commercial Aviation*, August 1941, page 50, 1 illus., also *Canadian Aviation*, page 31, 4 illus.

The Sportsman Test Pilot. James B. Taylor, Jr. A critical description of the 65 hp. Taylorcraft tandem trainer, giving a test-pilot's opinion of the flying characteristics, comfort and construction of the airplane. *The Sportsman Pilot*, September 15, 1941, pages 14, 15, 3 illus.

Fire Power Is Featured in Latest Nazi Fighter. The Messerschmitt Me 109F is described on the basis of reports from representatives of English aeronautical publications who were permitted to examine the airplane. Particularly noted are design improvements over the earlier model of the series. *Canadian Aviation*, September 1941, pages 31, 64, 2 illus.

Silvaire. A lengthy, conversational description of the flying characteristics of the Luscombe Silvaire. Extensive detail is afforded on the handling of the airplane in various flight attitudes and conditions. The discussion of performance is treated critically and comparatively, voicing general approval of the craft's all-round flying qualities. *Air Facts*, September 1941, pages 10–22, 5 illus.

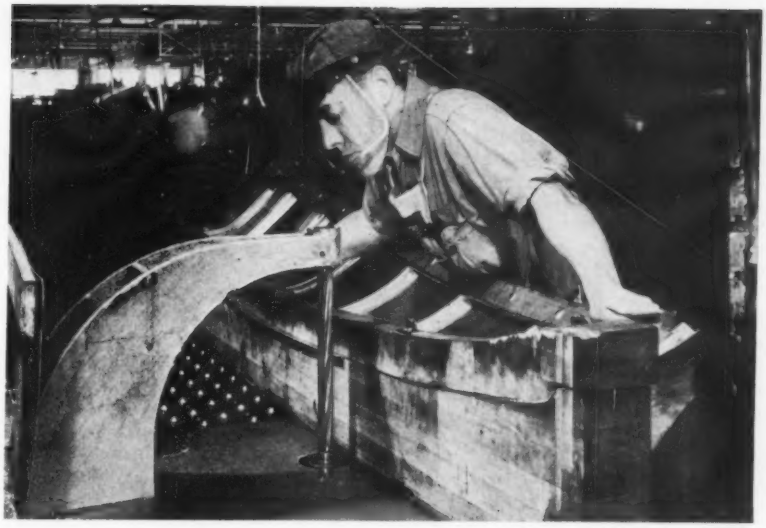
Airports

U.S. National Airport. Description of Washington, D. C.'s new National Airport, opened to service early last summer. Details are given on the construction and layout of the airport. *Commercial Aviation*, September 1941, pages 48, 50, 89, 5 illus.

Keep 'em Clear for Wheels. Discussing problems faced at Canadian airports in keeping runways clear during severe winter weather, this article presents a summary of the experience of several airport managers in seeking a satisfactory means of clearance. Various types of equipment devised to do this job are described, in particular the "Snogo" unit which blows snow well clear of landing areas after plow units have previously banked the snow at the edge of the runways. *Commercial Aviation*, August 1941, pages 64, 66, 68, 118, 120, 8 illus.

Stop and Go at the Crossroads of the Skies. A description of the control tower, ground station and dispatching office at the Chicago municipal airport. Traffic control duties and procedure are outlined together with details of the equipment and personnel. *Popular Mechanics*, October 1941, pages 34–37,168–170,12 illus.

The Farmer Builds a Field. James A. Wales, Jr. Suggestions for the layout and maintenance of flight strips or runways on otherwise cultivated fields. Flight strips approxi-



Using a router for trimming cowling stampings at the Curtiss-Wright Corporation's Airplane Division at Buffalo, New York.

mately a thousand or more feet long and a minimum of one hundred feet wide should be laid out paralleling the prevailing wind. There should be unobstructed approaches and crops adjacent to the runways should not be high enough to obstruct visibility while taxiing. Flight strips should be level, well sodded and with all stones, stumps, humps and gullies leveled. Inexpensive hangars, the wind sock, and general maintenance are discussed. *Air Trails*, September 1941, pages 24, 32, 2 illus.

Avigation

Eenvoudige Navigatie ten Dienste van de Sportvlieger (Simple Navigation for the Sport Flyer). J. W. Verhoeven. The seventh in a series on simplified navigation, this installment presents several types of compasses, namely the remote reading, earth inductor and sun types. *Luchtvaart*, July 22, 1941, pages 276–278, 5 illus.

Eenvoudige Navigatie ten Dienste van de Sportvliegers (Simple Navigation for Sports Flyers). J. W. Verhoeven. The eighth of a series on navigation, this installment describes the construction and application of the bearing compass, drift indicator, bearing plate, the "Le Prieur" navigraph and the "Plath" drift and ground speed indicator. Various types of computers are also described. *Luchtvaart*, August 5, 1941, pages 296–298. 11 illus.

From the Ground Up. Sandy A. F. MacDonald. An introduction to air navigation, giving primary definitions, elementary compass study and beginner's directions on compass reading. *Air Force Review*, September 1941, pages 10–14, 9 illus.

D/F Loop Navigational Techniques. C. H. McIntosh. The second article in a basic discussion on the principles and use of direction finding equipment. Principles and methods of loop orientation are outlined; means are discussed for ascertaining course to the station, selecting the nearest beam, homing and determination of station. *Aviation*, October 1941, pages 54, 55, 148, 150, 6 illus.

Business and Finance

Aviation and the Duration. Selig Altschul. A review of the current position of aviation's financial market with comparative notes on fluctuations since 1939 and on potentialities in future months. The writer comments that analysis of earnings reports clearly shows that the era of soaring profits in the aircraft industry appears to be at an end. While earnings will no doubt continue to show impressive gains throughout the rearmament period, the earnings increment rate, it is said, will not be as rapid as formerly and "it is likely that profits will not parallel the rising volume of deliveries." *Aviation*, October 1941, pages 83, 188.

Design

Why the Airacobra—and How? Lawrence D. Bell. The president of Bell Aircraft Corporation explains the background to the conception of the Airacobra. Strategic problems of warfare revealed by experience during the present European conflict are discussed in relation to their influence upon the essential design and construction of the Airacobra. The theory and research which went into the design and construction of

the airplane as an answer to these strategic problems are elucidated. *Commercial Aviation*, August 1941, pages 78–80, 3 illus.

Fire Power of the Airacobra. Percy T. Cole. A brief description of the arrangement of fire power on the Bell Airacobra and how it was adapted to the basic design of the airplane. *Commercial Aviation*, August 1941, page 96, 2 illus.

Armament and Armor. Clem G. Trimbach. A presentation of the fundamental problems of arming and armoring the modern military airplane. The problem of protecting the blind spots on a fighter or other military machine is only one of the phases of this design consideration. Self-sealing tanks and fuel lines and the special weight considerations involved in adding many pounds of dead weight to the airplane, complicate the problem of producing the high-performance airplane required for modern warfare.

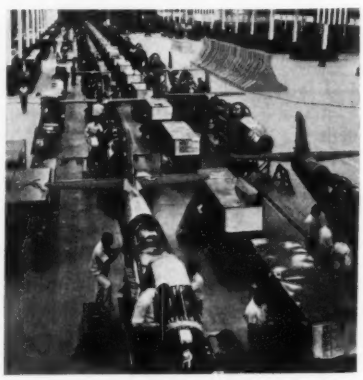
Between arms and armor, the vicious cycle continues. As the weight and fire-resistance of the armor is increased, heavier guns and more of them are added. As the methods by which wars are conducted call for greater versatility in the airplane, increased amounts of bombing gunnery, torpedo, smoke flare and similar equipment must be added. This article provides a summary of the current problem, indicating the direction in which design must go to achieve the goal of the maximum protection and fire-power possible without sacrifice of the airplane's functioning characteristics. *Aero Digest*, October 1941, pages 215, 216, 3 illus.

Warplane Specification Engineering. Peter A. Beck and Richard H. Robb. An explanation by members of Lockheed Aircraft Corporation's specifications staff regarding the complex problems involved in submitting proposals or participating in design competitions for military airplane production projects. *Aviation*, October 1941, pages 68, 69, 176, 178, 4 illus.

Tail Unit Design. Bruce Foster. Analyzing the problems contingent on the design of tail surfaces for modern airplanes, this article notes the factors which have altered the basis of tail design and cites current developments as evidenced in recent aircraft types. The old empirical formulas for tail surface area have in the last few years given way to new considerations, based on greater engine powers, giving more violent slipstreams; the higher standards of controllability demanded after failure of one engine; the greater wing loadings, reducing wing size; and the refinement in fuselage shape.

In a non-technical survey of the state of knowledge in this branch of aeronautical design today, successive changes in tail design of various outstanding large airplanes of recent vintage are discussed to show how controllability and stability of airplanes are improved through basic alterations in tail surface design. *Flight*, July 17, 1941, pages 34a–e, 20 illus.

Designing and Building the Airacobra. Omer L. Woodson and Harland M. Poyer. An outline of the many and complex design and construction problems met by Bell Aircraft Corporation engineers in perfecting the Airacobra as a mass production airplane. Some of these problems are explained in detail with technical notes on the solutions evolved. *Commercial Aviation*, August 1941, pages 86, 88, 90, 92, 5 illus.



The second power-driven assembly line, recently put into operation at the Bell Aircraft Corp.'s plant at Niagara Falls, New York.

Structural Features of Beads. F. R. Shanley. The chief structures engineer of Lockheed Aircraft Corp. discusses in this article how to use and when not to use beads for the stiffening of stressed-skin airplane structures. Basic theory and design problems in the use of beads to strengthen sheet metal construction are outlined in detail. A concluding section summarizes fundamental principles based on the discussion presented. *Aviation*, October 1941, pages 58, 164, 166, 168, 170, 10 illus.

Plastic-Plywood Design. Wendell S. Fletcher. The builder of the Fletcher basic trainer, a successful type of aircraft built entirely of plastic-bonded plywood, presents a study of the design problems peculiar to this type of construction. The article first clarifies the terminology and the materials involved and indicates the manner in which the prejudices against plywood construction of aircraft, stemming from some of the undesirable characteristics of former bonding agents, have been overcome by the use of modern plastic adhesives.

The general considerations of plastic-plywood construction are outlined in this article, and their application in the building of the Fletcher basic trainer are explained. *Aero Digest*, October 1941, pages 333, 334, 392, 5 illus.

Styling Aircraft Interiors. N. S. Leichter and R. S. Rose. A study of the problems involved in designing the inside of the passenger airplane with a view to comfort and the most efficient utilization of space and weight allowable for passenger accommodations. This involves certain considerations, among which are the function of the particular design and the amount of space and weight made available by the aerodynamics and structure of the particular design.

Some of the new ideas in seat and berth design which allow greater comfort for the weight and space allowed per passenger unit, the latest materials being considered for this purpose such as magnesium alloys and plastics and the basic theory of color arrangement for passenger comfort are discussed.

The procedure developed at Lockheed for interior design and other work of the engineering stylists is outlined. *Aero Digest*, October 1941, pages 55–57, 399, 400, 7 illus.

The Design of High-Speed Military Airplanes. Clarence L. Johnson. A discussion of design trends of the high-speed military fighter. Remarking the nature and basic purpose of the fighter in intercepting and shooting down bombers, the paper points out factors affecting its design, considering each in detail and in its relation to the composite problem of fighter design. The factors treated are performance, armament, ease of production, maneuverability, time required for development, flight qualities and cost.

In concluding, the writer suggests that in spite of the many problems presented by the pusher propeller, it "seems fairly certain on the basis of present data that it should be used." But, before they can be widely used, the problem of the pilot leaving the airplane with parachute must be solved. The military fighter is said to be inevitably becoming larger, more powerful, more costly and complicated. Speed limitations, it is noted, are too uncertain to bear discussion. The most useful outcome from the vast amount of research on military types at the present time will be its application to commercial models when the war is over. *Journal of the Aeronautical Sciences*, October 1941, pages 467—474, 13 illus.

Engines

Which? Are Air-cooled or Liquid-cooled Engines to Power American Pursuits? A review of the nature and the grounds of the controversy over the use of air-cooled as opposed to liquid-cooled aircraft engines. It is intimated that air-cooled power plants of 2,000 hp. for fighters appear to be the coming trend. *Commercial Aviation*, September 1941, pages 30–32, 4 illus.

Carburetion. Alex Lavendel. Part two of an article reviewing important contributions made to aviation by carburetor research. This installment undertakes a discussion of the development of superchargers, fuel injection, non-icing and de-icing equipment. It is concluded that modern, supercharged, high compression, high speed military engines will require some method of carburetion which will have to completely revolutionize the present methods in use, to keep pace with increasingly rapid development of aircraft engines. *Commercial Aviation*, August 1941, pages 30–32, 174, 7 illus.

Kinner Steps Up 15 Horses. Description of the new Kinner R-53, a 175-hp. engine which can be used as a replacement for either the 160-hp. R-55 or the 125-hp. B-54. Improved characteristics and specifications of the motor are noted. *Commercial Aviation*, September, 1941, page 92.

Mercedes-Benz DB-601A Aircraft Engine. Raymond W. Young. A paper on the design features and performance characteristics of the Mercedes Benz DB-601A engine. The major portion reports a teardown inspection of the engine with detailed descriptions and comments on some of the design features of major component parts. The balance is given to a check of the magnaflux inspection method, analysis and comparison of materials, and comparison on quality of finish.

According to the specifications quoted, the engine is an inverted 60-degree V-type, with 12 cylinders in banks of six, liquid-cooled Otto-cycle engine and fuel injection. Bore and stroke are 150 × 160 mm., displacement is 2,070 cu. in. and compression ratio is 6.74 : 1.

Physical and performance characteristics of the engine are compared with contemporary American, British, French and German powerplants of the same general design. It is said that German and French liquid-cooled designs tend toward larger displacement and lower crankshaft speed than is American and British practice; that the Germans favor the inverted type of construction in in-line engines because of the excellent visibility which this type permits in a single-engine airplane; and that American and British engines average about 5.7 per cent higher in b.m.e.p. under military rating.

Regarding workmanship and quality of finish, it is concluded that no useless effort has been expended where there is not a direct return in increased reliability and performance, and that handiwork in the polishing of stressed parts is of the highest order. Although stating that the design represents good mass-production practice for military aircraft engines, the writer notes that the highly stressed bolts do not have ground threads. He indicates that performance seems to be on a par with contemporary powerplants of the same general type. *S.A.E. Journal*, October 1941, pages 409–431, 39 illus.

Casting Cylinder Heads. A brief outline of the line production of aircraft engine cylinder heads as produced at the Fair Lawn foundry of Wright Aeronautical Corporation. *Aircraft Production*, September 1941, pages 334, 335, 8 illus.

Providing the Power for Canadian Tigers. Notes on the manufacturing practice of Menasco Manufacturing Company's new Burbank plant in the production of engines for Tiger Moth trainers employed by the R.C.A.F. Some of the minimum tolerances maintained in the fabrication of this engine are indicated. *Canadian Aviation*, August 1941, pages 48, 53, 4 illus.

Flight and Ground Equipment for Engine Testing. R. S. Kinsey and H. J. Knell. The equipment used in testing Wright engines on the ground and in the air is described by the company's flight test supervisor and the assistant plant engineer. The article indicates that, while ground tests are reliable in certain cases, concrete performance predictions can be gotten only in flight, as it is impractical to reproduce conditions of attitude, acceleration and atmospheric change on the ground.

The factors affecting engine performance, the problems of maintaining the flow of fuel and circulation of lubricating oil under high performance and aerobatic operation, as well as the effect of high altitudes on power production, ignition, lubrication, carburetion and cooling are examined, as well as the newer problem of utilizing the energy of the exhaust gases for turbo-supercharging and jet-propulsion.

The general equipment of the experimental flight hangar at Caldwell-Wright Airport for the handling of engine tests and the specially designed photographic equipment used to record the instrument readings taken in flight are described.

The report also contains a comprehensive technical description of the engine test stands used for ground-testing the power plants and its method of operation, as well as the single-cylinder testing equipment used to determine the durability of smaller portions of the engine. *Aero Digest*, October 1941, pages 196, 199, 200, 203, 204, 9 illus.

Kinner's New Engine R-53 Develops 175 H.P. The new engine designed by Kinner Motors, Inc., supplier of engines for Canadian elementary trainers, is described and compared with the forerunners of its series. Among the improvements noted is the oil system which is designed to reduce outside oil lines to a minimum. Some specifications are given. *Canadian Aviation*, September 1941, pages 37, 64, 1 illus.

Progressive Assembly of Wright Engines. Kenneth Sutton. A history of the conversion of the assembly system of Wright Aeronautical Corporation from the "spot" system, where four mechanics, in an eight hour day put a single power plant together, to the present line assembly method.

The account also follows a power plant down the assembly line, indicating the time it takes to put together each sub-assembly, install it onto the main unit, run the new power plant, tear it down, re-assemble it and get it ready for shipment. The actual work involved in each operation is described briefly. *Aero Digest*, October 1941, pages 192, 194, 305, 5 illus.

More Horsepower for National Defense. P. W. Brown and H. E. Linsley. The national defense program called on Wright Aeronautical Corporation to increase its monthly output from 264,000 hp. to almost 2,000,000 hp. This expansion required not only an expansion of factory space and personnel but the alteration of the entire system of engine building from skilled hand operation to mass production and line assembly.

This article gives an account of the training program that is under way to provide adequate manpower, also the application of semi-automatic machines and special single purpose machines used to step up the output.

The operation of such special machines as the Greenlee transfer machine, which can produce a finished cylinder head in 45 seconds, improved and accelerated balancing and inspecting devices and other recent

production aids used in mass power plant building are described. *Aero Digest*, October 1941, pages 176, 179, 181, 152, 305, 11 illus.

Ground Testing Power Plants. T. G. Hill and A. A. Joyce. When building the Soviet Clipper five years ago, The Glenn L. Martin Company developed the technique of engine ground testing for the first time. This article describes the test equipment and procedure as now used by the company. The use of the test data and the value of this type of test are explained. *Aviation*, October 1941, pages 64, 65, 150, 162, 3 illus.

Engines, Radial? In-Line? William B. Stout. A presentation of one of the most controversial subjects in aviation, that of in-line vs. radial engines. The writer opens with a description of the background of engine types, indicating that the major controversy was not as to design types but between automobile men trying to make a motor car engine do an airplane power plant's work.

The author presents the argument that the automobile type of crankshaft and cylinder arrangement that must be split in the middle for easy installation is structurally unsound. He also points out that the long crankshaft cannot be made to stay straight and that, when supercharged, the cylinders on a radial are equidistant from the supercharger, while their distances vary in the in-line type. Suggestions for future simplification of light airplane engines are offered. *Aero Digest*, October 1941, pages 318, 322, 326, 357, 358, 392, 9 illus.

Engine Air Filters. William K. Gregory. A discussion of air filter protection for aircraft engines against severe dust conditions. The characteristics of an ideal air filter for this purpose are described in some detail and the installation of air filters is discussed from the point of view of airplane design. *Aviation*, October 1941, pages 70, 180, 3 illus.

Compounding—Facts and Fallacies. Ford L. Prescott. A report of tests on a two-cylinder "compound" engine provided with a high-pressure cylinder which serves as a compressor as well as a working cylinder. The primary consideration in the tests undertaken was the extracting of additional work from the already partially expanded gases from the high-pressure cylinder. A secondary consideration was the use of the same low-pressure cylinder as a second stage compressor to aid in supercharging the high-pressure cylinder.

In reporting test results covering the development and testing program on the two-cylinder test unit, indicator diagrams showing the power developed in both high-pressure and low-pressure cylinders are presented. Test results are summarized by tabulating the representative runs and plotting the final runs. Results and conclusions are given.

Although the results of the test are not as good as desired, the writer concludes that the project is worthy of further development and research. *S.A.E. Journal*, August 1941, pages 326–331, 9 illus.

Range at Constant Speed. Norton B. Moore. An investigation of the difference at constant speed between the thrust horsepower required at the average weight, as commonly used in range estimates, and the exact "mean effective thrust horsepower" required over the weight interval, as defined in this paper. Use of this m.e.t.hp. in estimates of range at constant speed for high-altitude, heavily loaded airplanes is facilitated by curves giving it as a function of t.hp. required at the initial weight, of the ratio of final to initial weights, and of the basic performance parameter $\Lambda_{\sigma 1}$, at the initial weight of the airplane. *Journal of the Aeronautical Sciences*, October 1941, pages 465, 466.

Ein Neuer Raketenantrieb (A New Type of Rocket Propulsion). A study of the history and dynamics of rocket and jet propulsion starting with the work of Golightly in England (1841) and Ziolkowski in Russia. It outlines the basic problem, and explains some of the major contributions made to the advancement of jet propulsion by such persons as Lorin (1913), Whittle, Opel and others.

Some of the latest experiments by Secundo Campini in Milan which culminated in an actual ten-minute flight made by Mario de Bernadi in September 1940 are described, giving some material on the construction of the craft and the propulsive equipment applied. *Deutsche Allgemeine Zeitung*, May 18, 1941.

Fuels and Lubricants

The Present Status of Combustion Research. Ernest F. Flock. A review of a number of the more important contributions made recently to the knowledge of the process of combustion in the engine cylinder. Certain possible lines of attack which promise to lead to further improvements in the control of gaseous combustion as a source of power are stressed:

The finding of new mixtures which are inherently more powerful or more economical; the finding of new methods of altering the mass rate of burning; the completeness of combustion and also the rate of increase in pressure; the prevention of pre-ignition in spark-ignition engines and the facilitation of ignition in compression-ignition engines; and the suppression of detonation.

The need for an increasing amount of combustion research and the desirability for careful coordination are demonstrated by an examination of progress to date. *S.A.E. Journal*, August 1941, pages 332–338, 5 illus.

Flight Testing

Flight Testing Curtiss Airplanes. H. Lloyd Child. The chief test pilot of the Buffalo Division of Curtiss describes the work of the test-flight crew and relates typical recent jobs that he and the other eight Curtiss test pilots have completed recently. *Aero Digest*, October 1941, pages 219, 220, 308, 10 illus.

Flight Testing the Airacobra. F. R. Walker. An account of the nature of the tests made on Bell Airacobras before they are released to the U.S. Army. Most of the test flying of export versions is done at the point of delivery. The actual business of flight testing Airacobras is preceded by a careful ground inspection after which the airplane is given a comprehensive test flight together with 90 minutes of "slow time" flying to make certain that the craft is performing satisfactorily before cross country flying begins.

More than sixty items must be checked and noted before the Airacobra is turned over to government authorities. This article affords a step-by-step account of the work done, omitting only those items restricted by government regulations. *Commercial Aviation*, August 1941, pages 98, 106, 2 illus.

First Vega Ventura Test-Flown on Schedule. Brief note on the test flight of the first Vega Ventura medium attack bomber to come off the production line of the new plant which is producing the airplane in quantities for Britain. *Commercial Aviation*, September 1941, page 96, 1 illus.

Gliding and Soaring

The Importance of Gliding. Written by an anonymous noted Polish glider designer, this article cites the lesson to be learned from European experience with gliders and treats of the design and flight of unpowered aircraft. It is his claim that the development and encouraged use of gliders are great stimuli to the entire field of aviation. *Canadian Aviation*, August 1941, pages 26–28, 5 illus.

Glider Bandwagon. Alexis Dawydoff. A review of the renewed and sudden interest in gliding and soaring

which followed the German invasion of Crete with glider borne troops which has resulted in the introduction of a bill before Congress appropriating five million dollars to do something about gliding. Much of the scramble is for the $8,000 or $9,000 jobs involved, if, as, and when the bill may be passed. It is suggested that if gliding is to be encouraged by the Government, let it be done along the lines of the present British plan, or follow the procedure of the C.P.T.P. *Air Trails*, September 1941, pages 27, 38, 4 illus.

High-Altitude Flight

Development of Substratosphere Flying. D. W. Tomlinson. The vice-president in charge of engineering for Transcontinental and Western Air, Inc., presents a review of the T.W.A. experiments and research which led to the realization of substratosphere flight. The equipment used and the successive steps taken in solving the problem of high-altitude flight on a practicable basis are described. *The Journal of Aviation Medicine*, June 1941, pages 136–143.

History

Ringing the Bell. An editorial on the origin and growth of Bell Aircraft Corporation, outlining the progress of the company from a laboratory with forty employees six years ago to a plant of 1,000,000 sq. ft. and 9,000 employees today. *Commercial Aviation*, August 1941, page 77, 5 illus.

Hoe Men in 1912 Over de Aviatiek Schreef! (An Opinion on Aviation in 1912). A reprint of an article written in 1912 reviewing aeronautical progress since the 18th century. As to the future of the airplane, the article stated that the vehicle had no commercial possibilities, but might become a popular sport at some future date. *Vliegwereld*, July 3, 1941, page 355, 2 illus.

Chronological History of Curtiss-Wright. A record of the accomplishments of the Curtiss-Wright Corporation and all its predecessor companies back to the Wright brothers and Glenn Curtiss. This includes early trials and records of both pioneer groups, their individual triumphs, and the spectacular records set by their equipment in the period before the first World War.

The World War period which produced the Wright-Martin Company and expanded the Curtiss enterprises and the production of these companies during the war are reviewed as well as their struggles in the post-war era. An account follows of the founding of the present Wright Corporation and its work in air-cooled engine production and the final consolidation of projects which make up the present Curtiss-Wright Corporation. Airplanes, power plants and accessories made by the Curtiss-Wright group are listed and a chronology of the company's progress and expansion to date is presented. *Aero Digest*, October 1941, pages 150–155, 306, 31 illus.

United Air Lines—An Industry Portrait. Selby Calkins. A review of the growth of the United Air Lines system from the start of air mail transportation by private contractors in 1926. The events and personalities attached to the company's growth during these fifteen years are recorded here with reminiscences of highlights by the organization's pioneers. *Western Flying*, September 1941, pages 18–21, 42, 44, 22 illus.

Historia de la Aviacion (History of Aviation). Continuation of a series of articles on the history of flying, this installment deals with the use of captive balloons for observation and photographic purposes during the first World War, and how they became a favorite target for fighter airplanes. *Aeronautica*, July 1941, page 27.

Icing

Icing Problems in Operation of Transport Aircraft. R. L. McBrien. A paper presenting information obtained principally from trip icing logs and test flights conducted on a major transport system. A copy of a trip icing log is included to show the type of information obtained from normally scheduled flights. The different types of ice formed are explained and the general effect upon the performance on the airplane for each type of ice is stated.

Airplane ice accumulations are divided into two major classes: (1) those producing a loss of flight performance, and (2) those which serve as an annoyance to the crew. The main portion of the paper deals with these two classes, explaining when, how and why they are of importance. Numerous pictures are shown depicting the various conditions which were found to exist in scheduled air line operations and the shortcomings of the present anti-icing equipment are explained. Consideration is given to ice accumulations on the wings, empennage, propeller, pitot mast, radio loops, windshield and so on. *S.A.E. Journal*, September 1941, pages 397–408, 38 illus.

Icing of Carburetor Air Induction Systems of Airplanes and Engines. Victor J. Skoglund. Report of an investigation made in conjunction with the development of a new commercial airline powerplant installation. Laboratory tests were made of the icing of all critical parts of the carburetor air induction system, from the air scoop entrance to the supercharger impeller. Flight tests were made to establish a basis for the laboratory tests.

The laboratory program and apparatus were examined by all concerned and the results obtained were compared with actual operating experience to insure that they had a direct practical application. Tests included about 75 runs of full scale icing of the scoop in an 18 × 63 in. refrigerated wind tunnel and about 275 full scale runs of carburetor and engine induction system icing with a selected fuel in a complete running engine rear section. A laboratory was constructed for the latter tests, which included refrigeration, heating, and humidification equipment for producing cold and preheated carburetor air over a wide range of conditions.

The results of this investigation were: (1) a recommendation for radical changes in the original design of an air scoop which should make it possible to operate the scoop, without danger, under the most severe impact icing conditions; (2) the effect of a wide range of a large number of variables on the formation of ice on all parts of the induction system; (3) the extent of the induction system icing hazards, and effectiveness of preheat in preventing and removing ice formed with a conventional type and a new type of fuel discharge nozzle; (4) the relative effectiveness of preheat and alcohol in removing induction system ice. *Journal of the Aeronautical Sciences*, October 1941, pages 437–464, 25 illus.

Instruments

Aircraft Directional Instruments. Part of *Western Flying's* "Technical Section," this item is the first of a series on aircraft instruments, which is intended, when completed, to serve as a reference to the operation and function of every unit found on the panel of the modern aircraft. This installment leads off with a discussion of compasses and direction indicators (including the new remote-indicating unit). *Western Flying*, September 1941, pages 29, 30, 31, 4 illus.

The Automatic Pilot. An explanation of the nature, function and use of the automatic pilot unit, which has assumed especial importance recently since the accent on long-distance bomber flights and on trans-atlantic ferry operations. Principles of the unit's design and operation are outlined along with the follow-up

system, which provides the means whereby the applied control is removed as the airplane is returned to its normal attitude so that the control surface will be back in its neutral or centered position when the disturbance has been fully corrected. Other parts of the unit described are the directional gyro control, bank and climb gyro control, mounting and servo speed control valves. *Canadian Aviation*, September 1941, pages 26–28, 6 illus.

Timepieces Speed Accurate Navigation Computations. John P. V. Heinmuller. Study of the function of new timepieces, designed to simplify avigation. One of the latest of these is the Sidereal-Civil Time chronograph developed by Ward Knisley of Wright Field. This instrument has two 24-hour dials, one for each time system, working on a single mechanism, thus eliminating the chance for chronometric error.

A simpler avigational instrument is the Longines-Lindbergh hour angle watch. This watch has a movable bezel outside the dial, graduated in 1° to 5° with 15′ subdivisions.

Another late addition is the Longines Sidereograph which provides direct reading of time in degrees and minutes of arc. The middle scale covers 360°, 23 hours 56 minutes when rated to siderial time, while the center scale covers 10°, the outer scale, one minute of the arc. Each dial is distinctively colored as are its particular set of hands. Mathematics and directions for the avigational application of each instrument are provided. *Aero Digest*, October 1941, pages 68, 70, 72, 7 illus.

Lighter-Than-Air

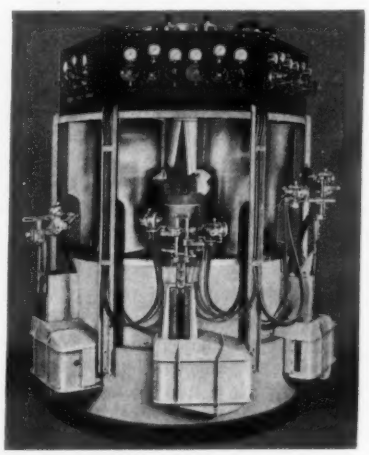
Thirty-One Years' Flotation. A notation of the activity of the R.F.D. company in providing barrage balloons, dinghies and flotation bags. The firm's work in this field was pioneered by R. F. Dagnall, who recently completed 31 years of design and production of balloons, flotation gear and pneumatic dinghies. Types of gear now produced by R.F.D. are illustrated. *Flight*, July 24, 1941, pages 48f, 48g, 8 illus.

Maintenance

A Salute to the Air Corps "Big Shot." One of the key men in the task of keeping the air force in flying shape seldom gets credit for the important work he does. This is the hangar chief, whose work is parallel to a railroad's head dispatcher or a factory foreman. Typical of these unsung heroes is Sergeant E. L. Schappaugh of Maxwell Field, Ala., who is charged with supervising the maintenance of 43 Army airplanes. This article outlines his work, indicating the many-sided character of the job and the extensiveness of the experience and leadership required by the noncommissioned officers who hold such posts. *The Sportsman Pilot*, September 15, 1941, pages 30, 32, 3 illus.

The Care of Aircraft Decorative Materials. Charles Froesch. The procedure in maintaining cabin upholstery, rugs, side walls and the remainder of the interior of the modern airliner is described by the chief engineer of Eastern Air Lines. *Aero Digest*, October 1941, pages 354, 357, 2 illus.

Aircraft Hydraulics. Part IV. Maintenance. James E. Thompson and Rodney B. Campbell. The last article in this series on hydraulic systems for aircraft, this installment discusses trouble shooting, repair, assembly and test. *Western Flying*, September 1941, pages 32–34, 52, 54, 6 illus.



The newly developed automatic machine for metallizing aircraft cylinders developed jointly by the Metallizing Engineering Co. and U. S. Galvanizing & Plating Equipment Corporation.

Design and Care of Cutting Tools. R. T. Wise. The second in a series of articles written by various persons and designed to provide practical, helpful information for the workers in aircraft plants. This article discusses the selection of the right tools to do the work, the proper sharpening and maintenance of the tools so they will produce the greatest number of parts and the right application of the tools so that the maximum productive capacity of the machine tools on which they are used may be obtained. Explanations are made by diagrams accompanied by captions. *Canadian Aviation*, August 1941, pages 44, 46, 64, 13 illus.

Metallizing as an Aid to Aircraft Maintenance. Ralph W. Dobbin. An increasing number of uses are being found for the metallizing process in aircraft maintenance. Particularly in airplanes used in salt water operation, metallizing cylinders with aluminum has been found superior to baked enamel as corrosion protection, the finish frequently surviving two or more overhauls without replacement.

This account describes the metallizing process as applied to aircraft maintenance, giving other applications, such as building up hubs and protecting fittings and exposed surfaces from salt water corrosion. *Aero Digest*, October 1941, pages 337, 338, 7 illus.

Manufacturing Equipment

Tool Them Up. Edward W. Falcon. Suggestions of a practical nature on how to get more production from present machine tool equipment. Because of unprecedented demands for machines, deliveries of new turret lathes are now often months in the future. But as yet there is no critical bottleneck in the supply of tools for turret lathes, a fact which presents manufacturers with the opportunity of stepping up production with their present equipment.

Included in available tools for turret lathes already in use are multiple turning heads, slide tools, adjustable single turning heads, tools for boring, recessing, facing and grooving operations, angle cutter holders, boring bars of all types, single and multiple cutter turners, end facing and end forming tools, adjustable knee tools, facing blocks, circular forming cutter holders, chucks, holding devices and many other items needed in tooling equipment. Some of these are described and illustrated by diagram. *Commercial Aviation*, September 1941, pages 75, 76, 78, 79, 17 illus.

Shop Equipment and Small Tools. This issue of the regular article on modern aids to efficient production describes equipment for dynamic fatigue testing, mould and core treatment and fire detection, and presents data on some new tools–an adjustable boring head, an optical clinometer, a screw-head slotting machine and a rotating stock stop. *Aircraft Production*, September 1941, pages 331, 332, 8 illus.

Modern Machine Tools. A description of recently designed machine tools for special-purpose grinding, threading and tapping, thread grinding, jig boring and milling, and slotting. *Aircraft Production*, September 1941, pages 336, 337, 5 illus.

Heat Treating Furnace Incorporates New Type Construction. A new heat treating furnace designed by the Despatch Oven Company is used for the solution heat treatment and aging treatment of aluminum alloy castings and shapes. It can also be used for tempering and drawing of alloy steels, normalizing and stress relieving of castings and welded sections, and numerous other heat treating processes requiring a temperature range up to 1,200°F. The new type of construction and the operation of the furnace are explained, with notes on the heating system. *Heat Treating and Forging*, August 1941, pages 397, 398, 1 illus.

Cutting Tools—Words of Advice. Thomas Arnold and R. T. Wise. The third and final article on this subject discusses the theory and practice in the use of various types of spiral fluted reamers. In concluding the series, a number of questions on cutting tools, asked by men in factories, are answered as an aid to meeting many of the problems that confront factory workers using cutting tools. *Canadian Aviation*, September 1941, pages 44, 46, 48, 50, 62, 17 illus.

Pneumatic Tools. Part IV. The last article in this series describes air-operated and hydro-pneumatic squeeze riveters and furnishes general notes on riveting practice associated with the use of these tools. *Aircraft Production*, September 1941, pages 323–326, 17 illus.

New Oxy-Acetylene Tube Welder Produced by Dominion Oxygen Co. A description of the design, operation and uses of a new automatic oxy-acetylene tube-welding machine. It is said to be capable of producing continuous welding of tubing from low-carbon, stainless and other alloy steel skelp at exceptionally high production speeds. *Commercial Aviation*, September 1941, pages 82, 84, 4 illus.

Materials

Magnesium Alloys. Part of Western Flying's "Technical Section," this item presents notes on the working properties of magnesium and magnesium alloys. The editor notes that in face of the aluminum shortage, magnesium might warrant more consideration than it received when first brought into practical applications several years ago. *Western Flying*, September 1941, page 31.

Surface Preparation for Painting Aluminum Alloys on Aircraft. Robert I. Wray. The description of the testing of two processes for treating aluminum alloy surfaces prior to painting. The Alumilite and Alrok processes were put under exhaustive test to fit them for use on aircraft surfaces. This paper reports the test methods and results. *Aviation*, October 1941, pages 83, 144, 146, 2 illus.

Flygplantankar var Alumin (Aluminum Tanks for Aircraft). Sven Petterson. The author presents the results of the Cooperative Fuel Research Committee investigation on aluminum as a material for fuel tanks. The work was based on heat-treated and non-heat-treated aluminum alloys and alclad. The results indicated that for spot welding of tanks, 17 and 24 St alloys were recommended. As to corrosion in tanks, the readers are referred to Ralph S. Barnaby's paper in the March 1939 issue of the Journal of the Aeronautical Sciences. *Flyg och Motor*, August 1941, pages 1–5, 5 illus.

Why Stainless Steel in Aircraft? Howard Biers. A study of the application of stainless steel as an aircraft material. The article first examines the steel itself, listing the advantages of the stock such as handling and forming characteristics, lower heat conductivity, corrosion resistance and flexibility under spot welding conditions.

The article outlines further the design characteristics which favor the use of stainless steel and goes into considerable detail in a summary on spot-welding and fabrication of the metal in aircraft production. *Air Force Review*, September 1941, pages 32–34, 2 illus.

Plastic Elements in Hydraulic Poppet Valves. W. C. Trautman. A development engineer of Bendix Aviation relates the progress of a program embarked on four years ago for the development of hydraulic valve systems superior to the steel ball poppet and seat type in common use. The need for hand lapping made this type expensive and difficult to maintain.

Various types of plastics were tried in conical and mushroom type poppets—neoprene, phenolic-resinous materials of various types and others. The phenolic resinous type proved most satisfactory, being able to seat itself directly in the aluminum alloy body without inserted seats, requiring no lapping for installation, being light weight and having excellent physical and service characteristics. The article outlines the research on the material and lists all of its advantages in this application over other materials. *Aero Digest*, October 1941, pages 329, 330, 4 illus.

Caucho Sintetico (Synthetic Rubber). A history of the beginning of synthetic rubber, a red-letter day in modern chemistry when Rev. Julius Arthur Nieuland discovered, in 1900, that acetylene and chlorides of arsenic and aluminum formed a poisonous black tar.

Since that discovery, synthetic products of many compositions have been manufactured by such U.S. corporations as Standard Oil, Goodrich, duPont and the Chicago Rawhide Company. This article offers a survey of the recent progress made in synthetic rubber and other plastics and the many uses to which they are being put in aviation and in general industry. *Aeronautica*, July 1941, pages 44–46, 1 illus.

B-19—Air Fleet Leviathan. General description of features of the Douglas B-19 bomber, with emphasis on the variety of uses to which plastics have been put in the construction and fittings of the airplane. Clear sheet stock, molded and laminated plastics were employed at a number of points.

The ignition systems of the engines depend upon the dielectric properties of plastics for operation, it is said. Spark plugs are energized and controlled by distributors insulated with, and having working parts made of, molded high impact phenolic. The insulation on the electric energy distributing equipment and other parts of the B-19 is of polyvinyl chloride.

In the "bridge deck," control devices are of molded cellulose acetate; navigation instruments are housed in compression molded thermo-setting housings. The control cables, reaching every part of the craft, are held in place and directed by pulleys, cable tracks and fair leads made of phenolic laminated materials. Combat stations, bridge and cockpits are enclosed in transparent housings formed from acrylic resin sheet. Other uses of plastics in the airplane are enumerated also. *Modern Plastics*, August 1941, pages 29–31, 94, 4 illus.

Medicine

The Effect of Military Requirements on Civilian Aviation. D. R. Brimhall. An outline of the extensive facilities of civil aviation in this country as adaptable to the requirements of a military emergency. The influence of military aviation and its requirements upon the growth and regulation of civil aviation is pointed out, particularly in connection with the physical and mental selection and the training of pilots under the Civil Aeronautics Administration. *The Military Surgeon*, August 1941, pages 155–160.

Solving Riddles of Aviation Medicine. A report of the medical research being constantly conducted by the R.C.A.F. to improve the selection, training and maintenance of air crews and to furnish increasing protection for them against the ef-

fects of high altitude, aero-embolism, low temperature and blackout. *Canadian Aviation*, August 1941, pages 21–23, 28, 53, 7 illus.

Effects of Reduced Atmospheric Pressures on the Electro-encephalogram. R. S. Lyman, W. A. Carlson and O. O. Benson, Jr. A report of an investigation of the physiology of flying at high altitudes. The portion of the study summarized in this report concerns tests during which brain waves were obtained from subjects in the decompression chamber at the Aero Medical Laboratory at Wright Field.

Twenty-two experiments were made on 17 subjects, of whom two were pilots of long standing. There was considerable individual difference in the preliminary electro-encephalograms and in the way the brain waves behaved at high altitudes. Periods of general flattening of the brain waves were common during "ascent." Otherwise, little or no change could be seen in the brain waves when two subjects were "taken up" to 35,000 ft. and one subject to 40,000 ft., to be kept there a few minutes with the oxygen mask on throughout. Other observations are also noted. *The Journal of Aviation Medicine*, June 1941, pages 115–125, 4 illus.

Necessity of Emergency Oxygen Unit for Use in Parachute Escapes at High Altitudes. Walter M. Boothby, W. Randolph Lovelace and Howard B. Burchell. Report of a delayed oxygen experiment in which a pilot became unconscious in a low pressure chamber at a barometric pressure corresponding to 35,000 ft. within 35 to 40 seconds after his oxygen supply was stopped while he was simulating preparations to bail out. His last act before becoming unconscious was to start the emergency oxygen supply, which he did too late, as he immediately "passed out" and the mouthpiece fell out of his mouth.

At altitudes in excess of 25,000 ft. the pilot has no time to lose and must start his emergency oxygen supply immediately. If he does not do this first, it will be too late. All other procedures for bailing out must be deferred until after oxygen is started. The emergency parachute oxygen apparatus must, therefore, be in place for instant use whenever a high altitude flight is undertaken. *The Journal of Aviation Medicine*, June 1941, pages 126–130.

Effect of Anoxic Anoxia on the Heart—Influence of Exercise and Effect of Acute Anoxia at Rest. E. J. Van Liere. Discussion of a study of the effects of repeated relatively short periods of acute anoxic anoxia on the heart while the organism was engaged in exercise and while at rest. Aviators may be exposed from time to time to brief periods of rather acute anoxic anoxia. Guinea pigs were used for the experiments reported here.

The results obtained were not statistically significant. Since strenuous exercise, however, may produce a moderate amount of cardiac hypertrophy in the normal animal and since anoxic anoxia may likewise do so, it is logical to assume, writes the author, that exercise under anoxic conditions should produce a noticeable cardiac hypertrophy. It is suggested that the work be repeated on dogs. *The Journal of Aviation Medicine*, June 1941, pages 131–135.

A Review of Modern and Recent Developments in the Science of Ophthalmology. Edward C. Ellett. A review of the tests to which flyers' eyes are subjected. Visual efficiency depends on three factors—visual acuity, motility and the field of vision. Each should be normal to insure perfect vision. The greater part of the tests made on flyers' eyes concerns one or another of these factors. Tests for determining the degree of efficiency in each of these factors are described in the order in which they are made. *The Journal of Aviation Medicine*, June 1941, pages 144–152.

Maneuver for the Relief of Acute Aero-Otitis Media. Harold Lamport. Otitis media is an affection of the middle ear due to inequality between the air pressures in the chamber of the middle ear and the atmosphere. It is found especially in susceptible persons in whom the middle ear has failed to be ventilated during descent in an airplane. In the normal person, ascent provides no problem.

This paper presents the results of a study of ventilation problems concerned with the affection. Forced inspiration at the end of forced expiration, with nostrils and mouth held closed, with voluntary ventilation of the middle ear or swallowing, followed by immediate release of suction, extends the critical range for the relief of the tympanic vacuum causing acute aero-otitis media. The degree of tympanic vacuum which the pharyngeal muscles controlling the ostium of the Eustachian tube can overcome is widely variable among different individuals. *The Journal of Aviation Medicine*, June 1941, pages 163–168.

Ear Conditions in Pilots and Radio Operators. H. B. Stauffer. A brief description of three general conditions produced by impacted cerumen in the ear canal. A treatment for such conditions is suggested by the writer on the basis of his experience with such cases. *The Journal of Aviation Medicine*, June 1941, pages 169, 170.

Super-Men for Super-Ships. John R. Hoyt. A discussion of a narrowing margin between the physiological limits of pilots and the demands of high-performance military aircraft. *Air Trails*, September 1941, pages 26, 36, 37, 2 illus.

Methods in Aerobiology. Oren C. Durham. Aerobiology is "the study of the aerial carriage of microscopic objects both indoors and outdoors." This paper is a discussion of the methods used in the study of air-borne allergens and in particular the value of flight as an aid in such studies. An allergen is a substance which in most cases is harmless when brought in contact with the body tissues, but which in certain persons, and for no apparent reason, causes severe and sometimes fatal reaction, the severity of the reaction usually varying in direct ratio to the amount of the substance encountered. Specifically air-borne allergens include certain pollens.

The history of research in this field is outlined together with a summary of the writer's own study and investigation of the subject. Sampling methods and exposure apparatus are described. Results of the writer's inquiry are presented. *The Journal of Aviation Medicine*, June 1941, pages 153–162, 3 illus.

Meteorology

Torra och Vata Termometern som Molnhojsmatare (Wet and Dry Bulb Thermometers as a Means of Measuring Cloud Heights). H. Hendrickson. Mathematical calculation of the height of cumulus clouds, based on comparative wet-bulb and dry-bulb thermometer readings. *Flyg och Motor*, July 1941, pages 1–3, 5 illus.

Nagot om Radiosonden ach dess Anvandning (Data on Radiosondes and Their Applications). Alf. Nyberg. Description of the radiosonde, the balloons used to carry them and the operation of their transmitting equipment. The article gives an account of the manner in which radiosonde data is used in forecasting. *Flyg och Motor*, July 1941, pages 1–3, 6 illus.

Fog and Stratus at Seattle. Wendell H. Woodward. A report of the reconnaissance survey of all low ceiling and fog conditions observed at Seattle during the four years 1936 to 1939. The survey was made to assist in forecasting fogs that affect Boeing Field. Following a general discussion of fog conditions in the area under observation, an analysis is given of the area's high fog and low

stratus, maritime low stratus and fog, pre-warm-front fog, post-cold-front fog and front-passage fog. *Bulletin of the American Meteorological Society*, June 1941, pages 239, 249, 11 illus.

Cyclogenesis over Southeastern United States and the Atlantic Coast. Sverre Petterssen. Brief abstract of a symposium on the influence of mountain ranges on cyclogenesis. *Bulletin of the American Meterological Society*, June 1941, pages 269, 270, 1 illus.

Weather for War. A review of the important part that long range weather forecasting plays in modern warfare. Much of the success of operations by mechanized ground forces as well as air forces depend on timing them to take advantage of favorable weather. More and more Army and Navy men are being trained in military meteorology at various colleges and universities throughout the country. Meteorological equipment and methods are shown and described. *Popular Mechanics*, October 1941, pages 51–53, 166, 167, 10 illus.

The False Horizon. Volney Finch. A study of the problem of atmospheric haze based on investigations conducted at Stanford University School of Engineering. The study of this common cause of poor visibility shows that it is in definable early morning maximum haziness periods that the upper boundary of the haze layer is occasionally very sharp, and presents to the aviator a well-defined, false horizon, sometimes called the "dust horizon." *Aviation*, October 1941, pages 73, 158, 3 illus.

Military Aviation

Bombing Pattern. "Rosnec." Presenting suggestions for improving the effectiveness of echelon formation in bombing flights, it is advocated that the well-known horizontal echelon be supplemented by vertical echelon. With the aircraft from the front to the rear of the horizontal parallel formation flying at staggered elevations as well as distance, the difference in height would confuse anti-aircraft gunners sufficiently to allow the harmless bursting of anti-aircraft shells between the aircraft in both horizontal and vertical planes. Confusion of the anti-aircraft height detectors is the essence of the scheme and the slight difference of a few seconds in the time of fall of bombs would be no disadvantage. *Flight*, July 17, 1941, page 34h, 1 illus.

How Warplanes Fight at Night. James L. H. Peck. A review of modern methods of waging war in the air at night. Offensive and defensive tactics and newly developed techniques in night fighting and aircraft detection at night are described, together with the organization and coordination of ground defenses. *Popular Science*, October 1941, pages 82, 88, 220, 222, 9 illus.

A Tool for Mr. Churchill: The Heavy Bomber. A detailed presentation of the United States' heavy bomber program, together with a discussion of problems of design, production, and high-altitude operation. A review is made of the race for bombers and fighters capable of operating at altitudes of from 30,000 to 50,000 ft. Daylight raids from 35,000 ft. on the German battleships Scharnhorst and Gneisenau in the harbor at Brest, made last summer by Boeing Flying Fortresses are mentioned and similar raids upon German cites are said to have spread consternation among the cities attacked.

The striking power of British and German bombers is compared to that of the Boeing B-17 and Consolidated B-24 types which are said to have a striking power unmatched by any foreign bomber now in evidence. It is said that the British having begun with a concept of airpower built around defensive fighters and medium and light bombers, are now belatedly and violently swinging around to the long-range, high-altitude, heavy bomber as the weapon of ultimate victory.

The true magnitude of the present 500-a-month program for the production of Boeing Fortresses and Consolidated Liberators, as the British call the B-24, is brought home by a listing of requirements, 420,000 workers, 180,000,000 lbs. of aluminum per year, and an outlay of $175,000,000 a month, or $2,100,000,000 a year, which is sixty-four times as much as was appropriated for the entire air-corps procurement program in the prewar year. It is described as one of the greatest industrial projects ever launched.

As the plan now stands orders in the B-17 pool have been divided between Boeing, Douglas and Vega, while the B-24 will be assembled by Consolidated and Ford, and subassembled by Consolidated and Douglas at the new Fort Worth and Tulsa plants, respectively.

While schedules and production figures are still unsettled due to retooling and expansion, production at Boeing and Consolidated is under way. From available figures output is estimated at approximately fifty bombers a month this fall, with a rise to a hundred a month hoped for by late spring. By the late spring of 1943 it is said that production should be approaching the desired goal, which should become an actuality by July, if all schedules are lived up to. Problems such as those of machine tools, subcontracting, manpower and management, and design, which can slow up the program, are also outlined. *Fortune*, October 1941, pages 78–83, 166, 169, 170, 174, 176–180, 182, 5 illus.

Tomorrow's Air Might. Maj. Gen. H. H. Arnold. A general evaluation of American air power, present and potential. Included is a discussion of potential manpower reserves and the quality of American military aircraft. The importance of expanding the number and size of military air bases is stressed as a vital part of the plan to build the strongest air force in the world. *Air Trails*, September 1941, pages 14–17, 33, 12 illus.

The Grasshopper Squadron—Flying Cavalry? Observations on the potentialities of light airplanes for military service as evidenced during recent Army maneuvers in the United States. Also noted are the many services which light airplanes can perform for national defense by guarding "civil necessities." *Commercial Aviation*, September 1941, pages 62, 64, 2 illus.

Parachutes

El Salto en Paracaidas con Apertura Retarda (Delayed Opening Parachute Jumps). K. Kaitanoff. The first in a series of articles translated from the Russian periodical Samolet, which indicates the military use for delayed-drop parachute descents. The author describes the operation of this type of jump and gives a table of records established between 1932 and 1938. *Aeronautica*, July 1941, pages 18, 19, 1 illus.

Personalities

"Dick" Depew. A personal sketch of the aviation background and activities of Richard H. Depew, Jr., executive vice-president and general manager of Taylorcraft Aviation Corporation. He is one of the very few pilots active today who learned to fly during the first decade after the epochal Wright brothers' flight at Kitty Hawk. In 1911 he learned flying under Maurice Farman at Buc airdrome, near Versailles and was awarded a pilot's license by the pioneer Aero Club of France the same year. *Western Flying*, September 1941, page 36, 1 illus.

Personairlities. Cy Caldwell. Personal sketches and career outlines of some of the key executives of the Curtiss-Wright Corporation. They include biographies of Guy E. Vaughan, president, and the general

managers of the various divisions, Myron B. Gordon of Wright Aeronautical, Burdette S. Wright of the Airplane Division, Robert L. Earle of the propeller division and John S. Allard of Curtiss-Wright Export. *Aero Digest*, October 1941, pages 239, 240, 242, 307, 10 illus.

Photography

High-Speed Photography and Its Application to Industrial Problems. E. D. Eyles. An informative paper on the nature of high-speed photography as adaptable to industrial needs. The history of the subject is outlined and the apparatus now in use is described. The technique of moderate speed, intermediate speed and high-speed recording are explained in some detail.

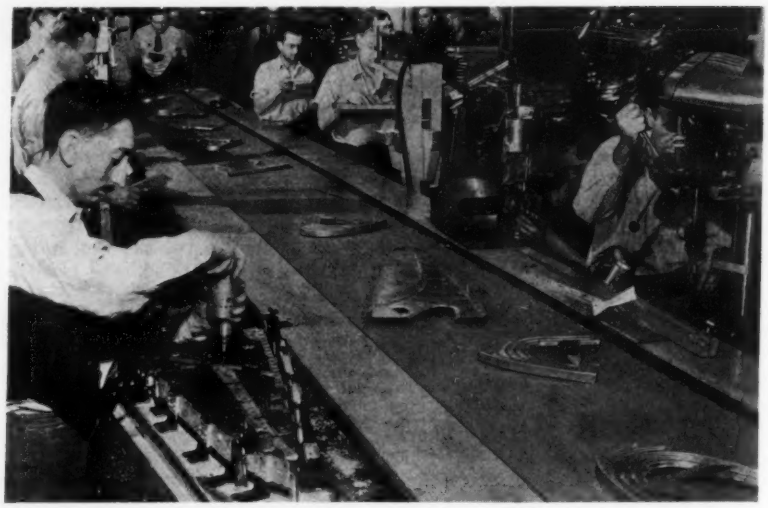
Among the numerous industrial applications developed, as brought out by this paper, are the uses of high-speed photography in the field of aerodynamic engineering. Such notable applications are mentioned as measurements of flight performance, the investigation of the discharge of aircraft from catapult launching gear, study of wind tunnel models, measurement of vibrations in aircraft structures and many other types of measurements. The method for making such types of recording is indicated. *Journal of Scientific Instruments*, September 1941, pages 175–184, 9 illus.

Honderdduizend Luchtfoto's—I (Hundred Thousand Aerial Photos—I). The first installment of a story covering a survey flight over Dutch East India for the making of a map of the country. *Vliegwereld*, July 17, 1941, pages 382, 383, 2 illus.

Plants

The Wright Aeronautical Plant in Cincinnati. Russell T. Howe and Robert K. Brown. A description of the new Wright Aeronautical engine plant in Cincinnati, one of the first government-sponsored defense plant expansions under the National Defense program. The reasons for the location are outlined with an explanation of the layout of the fifty acres of floor space.

The foundry production flow of cylinder heads for Wright Cyclone 14 engines is traced; operating capacity is 100,000 lbs. of aluminum-alloy castings each full working day. The flow of engine production is from rough stores, located under the mezzanine at the front of the building, toward the rear. The parts pass through final inspection, finished stores, assembly department and final test, thence to packing and the shipping department.



The newly installed small-parts conveyor belt at The Glenn L. Martin plant. The parts for a particular sub-assembly are made at positions along the belt, timed to arrive when the parts are needed by the assembling crew at the belt's end. Early counts indicate that this system has cut in half the man-hours required for the sub-assembly.

The account describes some of the production machinery, the powerhouse, chip salvage, plant organization, the air-conditioning system for plant and offices, and the underground cafeterias and restrooms. The cells and system for engine-testing are noted briefly. *Mechanical Engineering*, October 1941, pages 697–702, 9 illus.

Douglas Builds for War. Bert D. Lynn. The windowless "blackout" plant of the Douglas Aircraft Company and of its productive capacities are described, with notes on the functional layout and design. *Western Flying*, September 1941, pages 24–26, 46, 48, 6 illus.

De Roode Vogels van de Sovjets! (The Red Birds of the Soviets!) "Vortex." An account of the development of the various aircraft which comprise the Soviet air force, and a presentation of the most important state factories for aircraft production. Among the key factories described are those at Moscow which make pursuit and observation airplanes, components, bomb racks, machine gun turrets and similar components, at Voronesk which build the twin-engined S.B. series of light bombers and the plant at Perm which builds the M-25 engines—Wright Cyclones built under license.

Other key plants described are the Gorki establishment where the I-16 and 17 pursuit airplanes are built, the bomber plant near Moscow, the latest building, and others which fabricate the M-34, the Hispano and the Gnome-Rhone engines. The general observation is that the quantity is great, but the quality of the aircraft produced is doubtful. *Vliegwereld*, June 1941, pages 334–336, 6 illus.

War Bird Brooder. Charles F. McReynolds. A description of the "blackout" plant of Douglas Aircraft Company at Long Beach, California. Production planning, factory construction, building layout, plant equipment and facilities for personnel are outlined. *Aviation*, October 1941, pages 52, 53, 182, 5 illus.

Ten-Fold Expansion. Sidney H. Webster. The second of two articles describing the details of Eclipse Aviation's expansion in preparation for defense production. In conclusion the fundamentals of the program are summarized as: expansion of existing and leasing of additional manufacturing facilities; selection of subcontractors for the manufacture of complete units, tools and parts; the addition of a complete and modern foundry to maintain a continuous flow of castings to the production department; modernization of plant equipment combined with improved planning, production and inspection methods; and segregation of personnel requirements through the use of subcontracting plants, the training of unskilled labor and the addition of more personnel operating on a 2-shift, 60-hour week. *Aviation*, October 1941, pages 60, 61, 172, 174, 10 illus.

Design of Plants for Mass Production. Albert Kahn. General architectural considerations for airplane plants, discussed from the engineer's point of view. The writer is the head

of the group which designed and executed plans for the Curtiss-Wright Corporation's factory expansion program. He states the general consideration for building plants in which aircraft straight-line production can be carried on, such as layout, light, heat, ventilation, power, etc., and relates the short-cuts employed to save time between orders and execution. Structural details of some of the important plants are given in this account. *Aero Digest*, October 1941, pages 156–159, 305, 8 illus.

Private Flying

From Philadelphia to Seattle in a Fairchild 24 Seaplane. Alfred L. Wolf. An account of a leisurely overland trip from Philadelphia to Seattle in a Warner-engined Fairchild 24 on floats. The trip took seven days to complete, covering the 3,007 air miles in 37 hours, 15 minutes flying time. The account contains a day-by-day description of the flight, giving general flight and terrain conditions, seaplane facilities at the various stops and the personal reactions of the writer-pilot and his wife, who acted as co-pilot and general aide on the trip. *The Sportsman Pilot*, September 15, 1941, pages 12, 13, 32, 34, 36, 38, 6 illus.

Your First Cross-Country. Wolfgang Langewiesche. Seeking to explode the bugaboo of fear in connection with cross-country flying, this article stresses the importance of the pilot's doing his worrying in advance of such a flight, since "once you are underway, there isn't much you can do about it." Worry about the engine, for instance, can be saved by an advance check of five points: the spark plugs, the state of the ignition points, the fuel strainer, the carburetor bowl, the fuel and oil.

Suggestions are given for compass check, the use of landmarks including the correct use of railroads where necessary, the correct use of maps, and the checking of weather conditions prior to flight. The "four proper ways of flying cross-country," dead reckoning, course by compass, sighting over the compass and two-point navigation, are explained. One's cross-country troubles are said to arise not from inability to work any of these systems, but from the tendency to use several systems simultaneously. The essential idea of a navigational system is to first determine upon a definite procedure, check upon the results of the procedure and revise it if it seems to be failing. *Air Facts*, September 1941, pages 23–41.

Production

Speeding Final Assembly. Peter F. Hurst. The general manager of the Aeroquip Corporation offers in this article some pointers on how to save time in the significant last steps of aircraft production. The suggestions are based on principles of mass production, the elimination of production of any but necessary military and civil airplane types, and the development of airplane types along lines which permit their manufacture by any or all airplane manufacturers. *Western Flying*, September 1941, pages 39, 40, 6 illus.

Fleet 60 Manufacture Gets the Green Signal. R. Eric Crawford. The structural characteristics of the Fleet Fort (60) are noted in this article on the manufacturing practices which have been set up for its production at the plant of Fleet Aircraft, Ltd. *Canadian Aviation*, September 1941, pages 40, 42, 64, 9 illus.

Power Line Assembly of Aircraft. An account of Vultee Aircraft's power assembly lines and the plant layout used to ensure smooth work flow. The design and operation of the conveyor system are described with the step-by-step fabrication and assembly of airplanes along the power line. *Aircraft Production*, pages 308–310, 7 illus.

Single-Purpose Aircraft Machines. Paul Dubosclard. The increased number of aircraft being manufactured for national defense has given a limited opportunity for the application of single-purpose machinery, capable of performing a single-component operation with accelerated rapidity and with a minimum of opportunity for human error.

The president of the Farnham Manufacturing Company, which has built some of these special machines used in aircraft building, explains their use, design, operation and limitations. Spar millers, bending, drilling and countersinking machines are described. *Aero Digest*, October 1941, pages 341, 395, 3 illus.

Tooling the Martin B-26. Notes on the simplified production methods developed by The Glenn L. Martin Company to help speed production of the B-26 in face of skilled labor shortage. *Commercial Aviation*, September 1941, pages 44, 46, 6 illus.

Metal-Casting by the Antioch Process. Elmer J. Weinheimer. A description of the Antioch process for producing aluminum and non-ferrous castings for aircraft. Complicated parts unsatisfactorily cast by any other method can usually be produced by the new process since it permits the production of castings with practically any combination of curves, contours and angles, and thin wall sections having exceptionally high tensile strength. Smooth finish and unusual dimensional accuracy are outstanding features of castings made by the process.

The limitations and potentialities of the Antioch process are discussed in this review of Menasco Manufacturing Company's experience and research with the new foundry technique. *Aviation*, October 1941, pages 78, 79, 162, 188, 9 illus.

U.S. Aircraft Industry Reports. A statement of the current status of production in the U.S. for defense. The cooperative plan for producing 500 heavy bombers per month is explained. Expansion in facilities, personnel and equipment is noted, with figures on floor space and payroll. In-line production and some of the new machinery developments are described. The operations of the engine and propeller divisions of the industry are reviewed with a notation that engine production is now 4,000,000 hp. per month and is going up. *Commercial Aviation*, September 1941, pages 56, 58, 60, 4 illus.

Fleet "Fort" in Production. Reporting on the present stage of production of the Fleet Fort, manufactured by Fleet Aircraft, Ltd., this article describes the manner in which minor tooling problems resulting from changes to the first production model are being ironed out. Various stages of the fabrication process are outlined. *Commercial Aviation*, August 1941, pages 57, 58, 60, 15 illus.

Bell Plant Production. Percy T. Cole. A summary of the plant layout and procedures at Bell Aircraft Corporation which have contributed so extensively to successful mass production of Airacobras. With simplicity as the keynote of its efficiency, the Bell production program underwent months of planning to achieve the ultimate correlation between simplicity of production practice and efficiency of airplane design. The manner in which this was accomplished is briefly described. *Commercial Aviation*, August 1941, pages 82, 84, 100, 107, 2 illus.

Conveyors Successfully Used by Bell Aircraft. Henry K. Beebe, Sr. The means and manner by which conveyors were introduced into plant procedure for Bell Airacobra production are described in this article by the company's plant engineer, who writes of the production bottlenecks which called for the use of a conveyor system at the Bell plant. *Commercial Aviation*, August 1941, pages 94, 100, 1 illus.

Production Illustrations Speed Aircraft Assembly. George Tharratt. An account of the work of the production illustration group of the Douglas Aircraft Company. The group specializes in cutaway three-dimensional drawings which portray in simple fashion the manufacturing details of airplanes. The system is said to speed up considerably the planning and operation of assembly lines for mass production, since illustrations of this type are more readily understood than the customary blueprint. The problem of training hundreds of workmen is thus simplified and time saved in the shop.

The illustrations, called "illustrated job tickets," give the workman a clear picture of the job as he will see it on the airplane, together with a list of parts necessary to be assembled, a list of nuts, bolts, screws and clips to attach the parts, and a list of tools to do the job. Typical illustrations are reproduced and described. *Mechanical Engineering*, October 1941, pages 723–726, 6 illus.

Milling Cutter Feeds. A brief summary of German data giving recommended feeds per tooth for milling cutters. One of two tables furnishes useful values based on Continental practice as regards various materials and types of cutters. The other contains the recommended cutting speeds for the materials given in the first table. *Aircraft Production*, September 1941, page 330.

Stamping Trends in the Aircraft Industry. John H. Engel. A review of new designs, methods and processes that have and are likely to result from the entry of entirely new industries into mass production for the aircraft defense programs. Sometimes, old and proven methods used in other fields can be adopted. In other cases, new procedures or a combination of procedures have to be resorted to for the satisfactory manufacture of aircraft parts.

Such new and improved procedures may consist of faster production equipment, types of dies, stage die designs, utilization of heat in order to make satisfactory production possible, or a combination of methods to accomplish the desired design. The fabrication of heavier high-strength materials required by the increase in size of modern aircraft can best be accomplished by drop hammer methods. The fabrication of strain hardened metals demanded by the need for superior strength in modern aircraft is most satisfactorily accomplished by impact compressions. The problems encountered and the methods used in these new procedures are discussed together with the hot forming of sheet steel. *Heat Treating and Forging*, September 1941, pages 462–466, 7 illus.

Fifteen Curtiss-Wright Factories. General description of fifteen major production units of the Curtiss-Wright Corporation and their production equipment and output. The various plants of the Curtiss-Wright Airplane Division, Wright Aeronautical Corporation and Curtiss-Wright Propeller Division are included in the survey. *Aero Digest*, October 1941, pages 160–169, 21 illus.

Consolidated Close-Up. Pictures with descriptive captions on production activities at Consolidated Aircraft Corporation. Various assembly bays are shown together with different models of long-range Consolidated bombers during the several stages of construction. *Air Trails*, September 1941, pages 10–13, 19 illus.

Hydro-Pressed Beads. J. A. Petrie. A discussion of the most practical and economical methods of forming beads in sheet metal for strength in aircraft construction. *Aviation*, October 1941, pages 59, 170, 7 illus.

Tank Production. An account of works processes employed by a subcontractor in the production of Anson and Hurricane types of fuel tanks. The production methods used involve a number of interesting tools and fixtures which are described. They are of such a nature as to impose small overhead costs on small initial contracts and are capable of being readily multiplied and embodied in a more intensive tooling program should production of larger quantities become necessary. *Aircraft Production*, September 1941, pages 327–330, 12 illus.

Australia's Aircraft Building Program. G. H. Mosher. A general account of the manner in which Australia, which entered the present war as a far from industrialized nation, is tackling and solving complex aircraft production problems. Australia is well on the way to supplying her own needs in military trainers from Australian aircraft factories, according to this writer.

Commonwealth Aircraft Corporation's Wirraway trainer and de Havilland Aircraft's Gypsy Moth trainer represent two building projects. The two companies are today producing between them something like 1,000 aircraft a year. The third aircraft building project is the construction of Bristol Beaufort bombers. Britain's ban on the export of aircraft parts and raw materials last fall is blamed for the hold-up in the Australian Beaufort production. Aside from supply shortages, the main hold-up in Beaufort construction is laid to lack of coordination among the subcontractors.

In the raw material field, Australia is supplying her own steel for the fuselages of Wirraway trainers, and has recently gone into production on aluminum alloy skin for the coverings. The problem of aircraft instruments has been met by Amalgamated Wireless of Australia, which is now building gyro-horizons, directional gyros, compasses, altimeters, air speed indicators, and several other types of instruments. *Commercial Aviation*, September 1941, pages 27–29, 54, 7 illus.

Wings for the Catalinas. Randolph Hawthorne. An account of Brewster Aeronautical Corporation's production of wings for Catalina patrol boats under subcontract with Consolidated Aircraft Corporation. Production flow, facilities and methods are described. *Aviation*, October 1941, pages 74, 75, 140, 142, 10 illus.

Mass Production of Airplanes. Peter N. Jansen. How the Curtiss-Wright Airplane Division changed over from peacetime hand production of military airplanes to mass production is related by the corporation's general factory manager. The problems which arose in plant and production tool expansion, in fabrication methods, material procurement and personnel training, and the means by which they are being solved are described. *Aero Digest*, October 1941, pages 171–175, 191, 8 illus.

Propellers

Hydromatic Airscrews. Part II. Continuation of an article on the hydromatic propeller. The first part described the general design and operational features of the propeller, giving details of the production of the inner cam barrel, hub casing and inner gear segment. This second installment outlines in detail the production of the hub spider and blades; an account is given of the machining and lathe operations on the hub spider and the taper drilling contour milling, grinding and balancing of blades. *Aircraft Production*, September 1941, pages 311–320, 36 illus.

Simplified Cruising Control. Allan A. Barrie and John B. Cutting. The constant speed propeller has made it possible to operate aircraft engines at constant b.m.e.p., resulting in substantial operating economies. This article presents a method for constant b.m.e.p. airline operation, as developed by Western Air Lines in an effort to bring operating technique abreast of the equipment developed for b.m.e.p. operation. The problems

encountered in evolving an efficient and dependable technique are discussed. *Aviation*, October 1941, pages 56, 57, 154, 156, 158, 8 illus.

Operation of Propellers Under War Conditions. George W. Brady. Propeller repairs under wartime conditions occur a great deal more frequently than they do under normal operation. This article compares the various types of propellers now in use in the European war. The Rotol, de Havilland, VDM, Hamilton Standard and Curtiss Electrical propellers are compared as to construction and operation and resistance to normal erosion and abrasion caused by operation from rough fields.

The frequency with which repairs are necessary during wartime, makes ease of repair an important factor. A comparison is provided on the extent to which dural, hollow steel and wooden blades can be damaged and successfully repaired. Some of the new propeller types, such as the four-bladed propellers and the hollow hub models for hub-firing cannon are discussed as well as the considerations for propeller controls and spinner designs. *Aero Digest*, October 1941, pages 207, 208, 210, 212, 9 illus.

Methods of Producing Curtiss Propellers. Ralph J. Schneider. A comprehensive description of the procedure used in producing the Curtiss electrical propeller. The account begins with hub forging, tracing through the drilling and boring machines, the multimatics, and the horizontal milling machines and the various other grinding and heat treating processes to its completion.

The production of propeller blades is also traced from the sheet stock through stamping, welding, finishing and other operations necessary for their completion as parts of the completed airscrew. *Aero Digest*, October 1941, pages 184, 186, 188, 191, 9 illus.

Radio

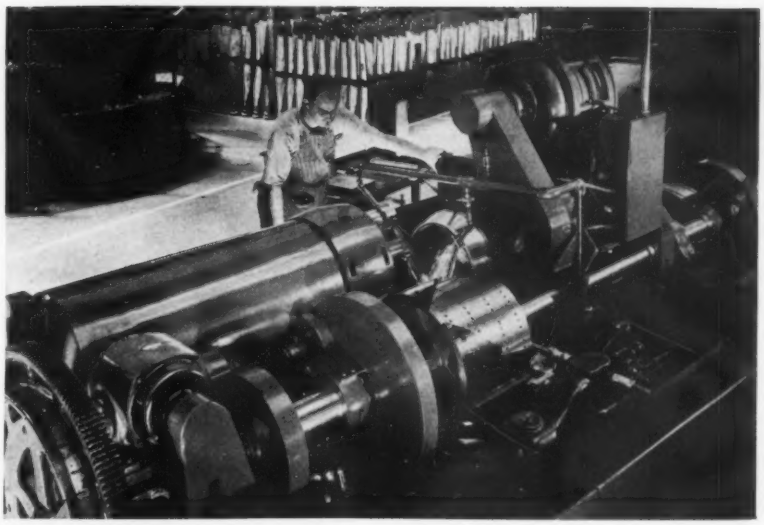
Calibration of the Radio Compass. David S. Little. Directions for the proper installation and calibration of the radiocompass, giving particular precautions on the location of the antenna and methods for calibrating the instrument in flight. *Aero Digest*, October 1941, pages 58, 59, 395–397, 6 illus.

Stress Analysis

The Circular Cylinder With a Band of Uniform Pressure on a Finite Length of the Surface. M. V. Barton. In this paper, the Papcovitch-Neuber solution is applied to the fundamental problem of a cylinder with a uniform pressure over one half its length and a uniform tension on the other half. The results, given analytically in terms of infinite-series expressions, are exhibited as curves giving a complete picture of the stress and deformation. The case of a cylinder with a band of uniform pressure of any length, with the exception of very small ones, is then solved by the method of superposition. The stresses and displacements are evaluated for the special cases of a cylinder with a uniform pressure load of 1 diam. and 1/2 diam. in length. The problem of a cylinder heated over one half its length is solved by the same means. *Journal of Applied Mechanics*, September 1941, pages A97–A104, 25 illus.

Action of Deep Beams Under Combined Vertical, Lateral, and Torsional Loads. C. O. Dohrenwend. A discussion of the behavior of beams when the primary vertical load acts at the same time as the secondary lateral and torsional loads. Beam loading of this type occurs in the case of shop traveling cranes, measurements indicating that the lateral and torsional loads are much smaller than the primary vertical load.

The writer considers the problem of the "deep beam" in which the moment of inertia of the cross section about the horizontal axis is much greater than about the vertical axis. The solution is achieved by determining the equation of twist in the beam and the moment or load where small increases of their values cause large increases in the values of angle of twist. *Journal of Applied Mechanics*, September 1941, pages A130–A134, 4 illus.



Machining high- and low-pitch stop rings for Hamilton Standard hydromatic propellers.

Training

Propeller Personnel. Norman A. Kirby. In view of the high proportion of skilled labor necessary for propeller production, acquiring personnel for the propeller division of Curtiss-Wright proved to be a more difficult task than similar expansion in other divisions of the corporation. The division personnel director describes the program, started in 1940 for the hiring and training of new men.

The general methods of training and courses of study and practice are outlined, as well as the observation standards by which indications of leadership, manifested by the new men are recorded for later reference in selection for promotion. *Aero Digest*, October 1941, pages 224, 227, 2 illus.

De Grondzwaai (The Ground Loop). A brief analysis of the causes of ground looping and how it may be prevented. *Vliegwereld*, July 17, 1941, page 384.

The Pre-Flight Reflex Trainer. Ben H. Pearse. Description of a new training device to speed up training time. Conceived by Col. William C. Ocker and Maj. Carl J. Crane, who together have been responsible for several other aids to flight training, the device is called the pre-flight reflex trainer. It consists principally of a canvas-covered cockpit suspended in a triangular frame which is mounted on wheels and powered with a 1/2 hp. motor.

Seated at the controls, the student put-puts around a large concrete platform making turns and banks, glides and climbs and figure 8's trying to avoid tripping the warning horn which blares whenever he overbanks or makes a mistake in coordi-

nating the controls. Past development in various types of training devices is reviewed. *U.S. Air Services*, August 1941, pages 16, 17, 1 illus.

So You Want to Be an Airline Pilot? Capt. George Myers. United Air Lines, realizing that the advent of national emergency would shut off their supply of new pilots from Army and Navy sources, set up a special training school at Tracy, California, to assure an adequate supply of co-pilots for replacement and expansion.

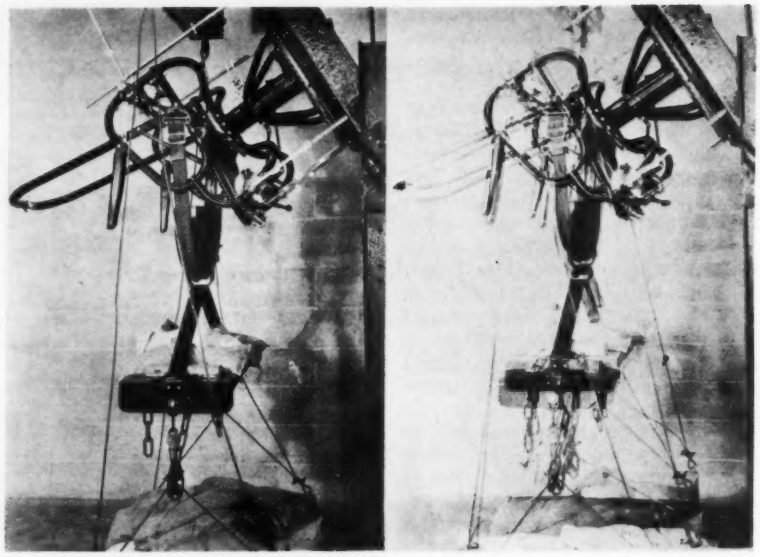
This article relates how the cream of the Civilian Pilot Training Program's graduates are selected and trained to take their place as airline pilots. Qualifications for selection, both personal and educational, and the course in navigation, communication and theory as well as actual flying are described. *The Sportsman Pilot*, September 15, 1941, pages 16, 17, 30, 32, 34, 4 illus.

School in the Sky. William Flynn. A description of United Air Lines' pilot training school at Tracy, California. The manner in which this type of training is tending to meet commercial pilot shortage and to put commercial pilot training on a permanent footing with highest standards and objectives is brought out by the writer in this explanation of the school's training program, facilities and aims. *Air Facts*, September 1941, pages 61–66, 1 illus.

Why Pick an Air School? John H. Riordan. The case for the aviation school or college vs. the regular college or university. Chief advantages are said to be more intensive training, immediate opportunity due to present expansion and future possibilities in the aviation industry, and less time between graduation and a job with an adequate salary. *Air Trails*, September 1941, pages 25, 39, 56, 57, 2 illus.

Training Productive Manpower. Charles S. Mattoon. The personnel director of the Curtiss-Wright Corporation's airplane division describes the method by which his group tackled the job of assembling and training sufficient labor to meet its defense production needs, outlining the procedure in procurement and selection and presenting some of the peculiar problems such as Selective Service competition encountered during the recent personnel expansion. *Aero Digest*, October 1941, pages 223, 224, 4 illus.

Aerobatics in the Air Force. Ronald A. Keith. An explanation of the use of aerobatics as part of the R.C.A.F. training procedure. Fancy maneuvers are discouraged and attention is concentrated on a few basic stunts which are calculated to give the pilot experience in all conceivable positions of the airplane. The article describes how the Harvard trainer is handled in the loop, slow roll and roll off the top. Characteristics of the standard advanced trainer in spins are noted. *Canadian Aviation*, September 1941, pages 19–21, 62, 6 illus.



A graphic record of the performance of a pilot's seat under load, made recently by the Warren McArthur Corporation. The picture on the left shows the seat in the test rig with the deflection gages attached and a 20 per cent load applied to take up the slack. When the test had reached full load, another picture was taken. Then the two negatives were superimposed and printed, the resulting picture (right) revealing how each part deflected from 20 to 100 per cent of the load.

What Makes an Air Gunner. Ronald A. Keith. An account of the methods, procedures and equipment by which Canadian air gunners are trained for the R.C.A.F. It is based on a standard half-hour training flight of the writer in a Fairey Battle, flying over the target ranges and going through the routine training evolutions. *Canadian Aviation*, August 1941, pages 24, 35, 36, 8 illus.

Warfare

Night Fighter Ops. A graphic description of a night spent with a Beaufighter squadron at a night fighter station. Without touching on aspects involving secret information, the effectiveness of radiolocation in controlling enemy aircraft detection and night fighter operations is clarified in a record of conversation by radio between the ground station and a fighter on patrol. *Flight*, July 24, 1941, pages 48d, 48e, 3 illus.

Beaufort. Description of a torpedo attack on a German pocket-battleship by Bristol Beauforts of the R.A.F. Coastal Command off the coast of Norway. *Air Force Review*, September 1941, pages 7, 8, 2 illus.

What If New York Is Bombed? O. B. Myers. An imaginary account of the first bombing of New York City. Based upon the known effects of bombing attacks, and upon a plausible estimate of the average American's reaction, it includes a graphic description of defense and air raid precautionary measures which are now being organized. *Air Trails*, September 1941, pages 18, 19, 30, 32, 7 illus.

Blueprints for Destruction. A number of tear sheets furnishing descriptive details about various types and sizes of bombs, together with their effective radii of destruction, penetration and effects. Explosive characteristics are shown and described as well as zones of penetration in buildings and air raid shelters. A table is included which gives sizes, specifications, and approximate costs of the different types. *Fortune*, October 1941.

"Nerve Center" Guards New York. Details of the recently completed air-defense information center in New York, N. Y. Minute-by-minute reports from more than 6,000 air observers will enable officers of the U.S. Air Forces to watch the progress of enemy aircraft over large-scale maps, and to direct both ground and air defense operations. Layout and organization of the system are discussed. *Popular Science*, October 1941, pages 89–91, 5 illus.

Reluctantly Getting Down to Earth. Cy Caldwell. A survey in retrospect on the effect of the air war on England, Germany and Russia. It con-

(Continued on page 58)

Government Publications

Congress of the United States

Laws Relating to Navy, Commerce and Air Services and Miscellaneous Air Laws. Compiled by Elmer A. Lewis. A compilation of all legislation on the Naval Air Service enacted from 1913 to 1940, on commercial aviation from 1916 to 1940, and miscellaneous legislation of general interest enacted between 1917 and 1940. Available through the Superintendent of Documents, Washington, D. C., 15¢.

Army Air Service Laws. Compiled by Elmer A. Lewis. A compilation of the acts of Congress affecting the Air Forces of the U.S. Army enacted between March 2, 1913 and October 14, 1940. Available through the Superintendent of Documents, Washington, D. C., 10¢.

Laws Relating to National Defense Enacted During Seventy-Sixth Congress. Compiled by Elmer A. Lewis. A compilation of laws relating to National Defense, enacted by the 76th Congress between April 3, 1939 and October 14, 1940. Many of these acts directly affected aviation. Among them were the resolution for air corps expansion enacted in response to President Roosevelt's message to Congress of January 12, 1939, the Civilian Pilot Training Act of 1939, the waiving of age limits for the appointment of air corps second lieutenants and many acts facilitating procurement. Available through the Superintendent of Documents, Washington, D. C., 20¢.

Civil Aeronautics Administration

Airplane Climb Performance. A general discussion on airplane climb performance, giving corrections for variations in atmospheric conditions, engine horsepower and airplane weight, prepared by the Flight Engineering and Factory Inspection Section of the C.A.A. The nature of the rate-of-climb curve vs. altitude, the definition of such terms as "pressure," "density," "equivalent" and "critical" altitudes are given, as well as comments on details and tables used in making climb corrections. Flight Engineering Report No. 3, 81 pages, 15 illus.

Aircraft Power Plant Cooling Tests. Interpretation and explanation of section 04.640 of the Civil Air Regulations which contains the tests required by the Civil Aeronautics Administration Engineering Section on power plant cooling. *Civil Aeronautics Journal*, September 15, 1941, pages 238, 241.

Vibration Testing Equipment Placed in "Mobile Laboratory" for Trials. Announcement of a mobile testing unit which is being completed at the C.A.A. experimental station at Indianapolis. Many of the instruments developed within the last two years for determining vibration and flutter characteristics will be incorporated in this unit. Part of the equipment will be installed in a truck to serve as a mobile laboratory while the remainder will be put aboard a transport type airplane. By thus mobilizing the equipment, it can be made available to more manufacturers. *Civil Aeronautics Journal*, September 15, 1941, page 239.

War Department

Parachutes, Aircraft Fabric and Clothing. A manual, prepared under the direction of the Chief of the Air Corps, on the construction, materials, maintenance and repair of parachutes, clothing, fabric covering, slip covers, upholstery, web belting and other materials used by the Air Forces which are made of some type of textile.

The manual describes the basic materials, gives some data on their composition and general handling. The machines used, the Air Corp's fabric shops, the characteristics and selection of seams and the general rules for maintaining, repairing and storing of clothing, cockpit covers, etc., are outlined.

Special attention is given parachutes and their handling. The construction and repair of the parachute is outlined in detail. Instructions and specific rules for their maintenance, packing, storage and use are given, along with 14 basic rules for handling the equipment with a view to lengthening its useful life. *War Department Technical Manual No. 1-440.* January 10, 1941, 119 pages, 95 illus.; available through the Superintendent of Documents, Washington, D. C., 15¢.

Notes on Psychology and Personality Studies in Aviation Medicine. A technical manual prepared under the direction of the Surgeon General for the purpose of aiding Air Force medical officers in selecting proper men for cadet training, thereby reducing the 61 per cent scholastic mortality current in the Army's flying schools.

The work offers a general introduction to the subject of psychology, breaks it down to its essential subdivisions, and then applies the material to the task of selecting future pilots on the basis of their psychological capability.

The method for arriving at a flying adaptability rating is outlined and illustrative case histories are provided. *War Department Technical Manual No. 8-420*, January 27, 1941, 335 pages; available through the Superintendent of Documents, Washington, D. C., 35¢.

Mata Hari With a Glass Eye. Lieut. Derryfield N. Smith. A study of the use and interpretation of aerial photographs in modern warfare. The air camera supplies, according to this article, about 80 per cent of the information used in determining strategy, and is frequently the sole basis for major tactical moves.

This report outlines the general procedure of taking, developing and interpreting aerial photographs, and follows the route of the military photograph from the camera to the war room, where its information is put to actual use and action. *Air Forces News Letter*, September 1941, pages 1–4, 1 illus.

Warriors from the Sky. Oliver Townsend. An account of the history and formation of the U.S. Army's Provisional Parachute Group, now being trained at Fort Benning, Georgia. The physical, service, and training requirements for volunteer parachute troopers is outlined, and the

general training which they are given in parachute technique, communication and military science is explained.

One of the newest additions to the parachute army, the special medical section is introduced. A group of specially selected physicians are being trained to descent to strategic places with specially designed equipment and render field medical service under emergency conditions. *Air Forces News Letter*, September 1941, pages 11, 12, 16.

Propeller Vibration Tests. Description of the equipment used by the Army for recording vibration in aircraft propellers. The equipment, installed in the airplane, functions automatically. It consists of a number of resistance pick-ups, batteries, an amplifier and oscillograph and collector rings.

The installation, operation and interpretation of the equipment and its record are explained. *Air Forces News Letter*, September 1941, page 4.

Relative Rank in World's Air Forces. A tabulation of the military titles of 11 grades of commissioned officers from Field Marshal to Second Lieutenant in the air forces of Argentina, Brazil, China, France, Germany, Great Britain, Japan, Italy, the Netherlands, Russia and Turkey. *Air Forces News Letter*, September 1941, page 13.

They Tuck Themselves Away. A study of the history and development of retractable landing gear from its first application in the Dayton-Wright racer in 1920 to the giant Douglas XB-19 bomber. The main problems in the design of this type of alighting gear, the increase in weight and the design changes necessary for the installation of the complicated mechanism, are compared with the increased speed available, and the conclusion is drawn that this type of installation is not justified in Army aircraft with speeds of less than 175 m.p.h. General procedure in the design of retractable undercarriages are outlined. *Air Forces News Letter*, September 1941, pages 14, 15, 1 illus.

Office of Emergency Management

Bomber. One of a series of short motion pictures on production for defense, this one-reel "defense report on film" gives glimpses of the test flying and mass production of a medium bomber, the Martin B-26. All the scenes were taken at The Glenn L. Martin plant in Baltimore.

The film begins with the opening of the large electrically motivated hangar doors, and a single B-26, completed and ready to fly, is pushed out onto the flight line for its initial hop. From here, the camera takes the audience into the plant to watch the bomber born from tempering baths, hydraulic presses, power cutters and riveting guns. The sub-assemblies grow before one's eyes, and flow smoothly together until finally, the airplane arrives full grown at the flight ramp.

The narration for this short was written by the distinguished American poet, Carl Sandburg. Typical of the descriptions in this work are his words on the power plants:

". . . raw, naked power—a Niagara of horsepower—
John Henry on one wing—Paul Bunyan on the other."

O.E.M. Defense Reports on Film, released by the Motion Picture Committee Cooperating for National Defense.

Air Lines Given A-3 Rating for Upkeep of Planes and Ground Equipment. Priorities Director Nelson issued on September 12 a limited blanket rating order to the nation's scheduled air lines, assuring them continuous operation. The order assigns the high defense rating of A-3 to material needed for the proper maintenance of the aircraft and ground equipment. The rating may be applied by the supplier of the material only if deliveries cannot be secured without it. *Defense*, September 16, 1941, page 5.

National Advisory Committee for Aeronautics

Temperature Recording in High-Speed Gases. E. Eckert. A report translated from the October 26, 1941 number of Z.V.D.I. on methods for recording the correct temperature of flowing gases which overcomes the potential errors involved through radiation on adjacent walls or dissipation in the thermometer. *N.A.C.A. Technical Memorandum No. 983*, August 1941, 12 pages, 13 illus.

Supplement to Comparisons of Automatic Control Systems. W. Oppelt. Supplement to Technical Memorandum No. 966, issued in February 1941, which contained a report dealing with a reciprocal comparison of different control systems. *N.A.C.A. Technical Memorandum No. 966* (Supplement) August 1941, 15 pages, 8 illus.

New Method of Calculating the Power at Altitude of Aircraft Engines Equipped With Superchargers on the Basis of Tests Made Under Sea-Level Conditions. Marcello Sarracino. Translation of the report entitled "Nuovo meto per il calcolo della potenza in quota dei motori d'aviazone muniti di compressore in base alle prove effettuate nelle condizioni al suolo." *Atti di Guidonia* No. 28, June 20, 1940. This report presents what is considered a simpler and more accurate method of determining, from the results of bench tests under approved rating conditions, the power at altitude of a supercharged aircraft engine, without application of correction formulas. *N.A.C.A. Technical Memorandum No. 981*, July 1941, 29 pages, 6 illus.

Observations of the Effect of Wing Appendages and Flaps on the Spread of Separation of Flow over the Wing. G. Hartwig. Translated from *Luftfahrtforschung*, March 29, 1941. Summarized in the *Aeronautical Review*, July 1941, page 9. *N.A.C.A. Technical Memorandum No. 988*, September 1941, 8 pages, 26 illus.

Factors Influencing the Fatigue Strength of Materials. F. Bollenrath. Translation of an article entitled: "Einflusse auf die Zeit- und Dauerfestigtigkeit der Werkstoffe." which appeared in Luftfahrtforschung on October 26, 1940. The report states that a number of factors are considered which influence the static and fatigue strength of materials under practical operating conditions, as contrasted with the relations obtained during the usual test procedure.

Such factors are, for example, interruption in operation, periodically fluctuating stress limits and mean stresses with periodic succession of several groups and stress states, statistical changes and succession of stress limits and mean stresses, frictional corrosion of structures and notch effects.

With the aid of a few examples taken from airplane construction, it is shown how materials testing procedure can take such effects into account as to provide the designer with a useful basis for better utilization of the material. Numerous instructive test results are discussed. *N.A.C.A. Technical Memorandum No. 987*, September 1941, 16 pages, 21 illus.

Air Transport by Glider. Wieslaw Stepniewski. Reprinted from *The Aeroplane* of April 25, 1941. Summarized in the *Aeronautical Review*, July 1941, page 17. *N.A.C.A. Technical Memorandum No. 980*, June 1941, 7 pages, 5 illus.

Tables for Computing Various Cases of Beam Columns. J. Cassens. Translated from *Luftfahrtforschung*, March 29, 1941. Summarized in the *Aeronautical Review*, July 1941, page 28. *N.A.C.A. Technical Memorandum No. 985*, August 1941, 14 pages, 3 illus.

Lofting Explained

A study of the various principles of fairing, development and layout used in the lofting of both ships and aircraft. In expounding the principles and explaining how they achieve their definite results, the author points out that the airplane loft is a development and refinement of the shipbuilding system.

The subject is introduced by a review of the elements of descriptive geometry. The method for depicting and dimensioning shape of drawings is broken down into the simplest possible language and applied immediately to a practical, simple problem of boat building. The conventional notations on plans are introduced somewhat unobtrusively and explained where their origin is obscure.

The science of actual lofting both for ships and aircraft is traced back to the Roman shipwrights who laid out the plans for galleys on temple floors, and the Vikings and Indians who staked the outlines of their crude vessels on the ground. The modern airplane and ship's loft is described and its use in transferring dimensions from plans to work is explained. This includes a study of the elementary geometry employed on the loft floor and the principles of plane and solid geometry as applied to the projection of lines and surfaces.

The two methods for arriving at the desired smooth flowing or fair lines which is the object of both aircraft and boat design, the visual and goemetric methods, are compared in two separate chapters.

The study of the development of the simple surface is, in this work, limited to the study of surface vessel construction, indicating, however, the points the instances at which the methods for aircraft and boat development are alike. The processes show their sharpest separation in the template stage. The use of the full scale mock-up and the application of the photographic template process are the points at which marine and aircraft lofting differ in the greatest degree. Considerable space is devoted to a study of photolofting as developed by the Glenn L. Martin Co. The work closes with examples of actual layout problems.

This work was written for draftsmen, loftsmen and sheet metal workers. In simplifying a highly technical problem, the writer has achieved an unique accomplishment; a certain unconscious beauty in language produced by the effort of crystallizing mathematics into simple language.

Ship and Aircraft Fairing and Development, by S. S. Rabl; Cornell Maritime Press, New York, 1941; 92 pages, $2.50.

Books reviewed in this section may be purchased, or borrowed without charge, from The Paul Kollsman Library, Institute of the Aeronautical Sciences, 1505 RCA Building West, Rockefeller Center, New York, N. Y.

Metal Properties at Sub-atmospheric Temperatures

A report, providing voluminous data on the impact resistance and tensile properties of metals at sub-atmospheric temperatures, is the result of two years' study by a joint A.S.M.E.-A.S.T.M. research committee. The information and data obtained by extensive circularization of laboratories known to be interested in low temperature were classified and supplemented by material from literature and critical comments. To make the publication more usable, a comprehensive bibliography and an index to the major topics covered in the volume are included.

Since the notable summary of available information by Russell in 1931, a great deal of data have been developed by producers and users of materials used at sub-atmospheric temperatures. Many of these data have been reviewed and are included in this latest report. Over 50 per cent of the material is in the form of 142 tables.

Following the discussion on impact resistance, which covers limitations, effect of testing variables, impact velocity and cooling technique (the impact test is an important means of evaluating low temperature properties of materials), there is a section devoted to impact data for non-ferrous materials, followed by the most extensive portion of the publication covering ferrous materials of a wide range. Fifteen pages of the report relate to low temperature tensile properties.

Impact Resistance and Tensile Properties of Metals at Sub-atmospheric Temperatures, prepared by H. W. Gillett; American Society for Testing Materials, Philadelphia, 1941; 112 pages, $2.50.

Personnel for Defense

With the demands upon defense industries, particularly those in or related to aeronautics, jumping by leaps and bounds, the problem of selecting and training workers for the multiplicity of production and service jobs becomes manifoldly more serious. The quantity of training literature in the form of textbooks, manuals and guides is doing much to expedite the training problem. But informative and useful studies of the selection and training problem in this emergency are fewer in number despite the great service they can perform for industrial leaders at this time.

The recent work of Charles Reitell is a competent, well-rounded introduction to this field of management, particularly in face of present defense needs. The book is intended to help in selecting and training workers and "in achieving better quality, higher output, lower costs and a finer spirit of cooperative goodwill." The textbook form of the work does not confine its use to students of management, for many a personnel and labor relations executive will find practical use for it.

An opening section on selection stresses the need for accurate selection after thorough and comprehensive analysis of applicants, and shows the way toward systematic analysis of this character. Sections on training concentrate on technique and standards out of which grow the guidance and leadership so essential to productive efficiency. A large portion of the work is given to a discussion of training in human relations, the best feature of which is its value as a guide to the understanding of the all-important "human equation"—the ultimate key to successful labor relations.

Training Workers and Supervisors, by Charles Reitell; The Ronald Press Company, New York, 1941; 182 pages, $1.25.

Handbook of Aircraft Instruments

The growth of commercial, private and military aviation together with the corresponding development in quality and dependability of aircraft instruments has increased the need for comprehensive texts and training material in the instrument field. Instruments play so vital a part in all phases of aviation that a thorough understanding of their functions and uses has become essential to anyone who wants to consider himself a safe pilot.

Probably no other unit requires a greater degree of skill, care and research in its manufacture than the aircraft instrument. Hence the preparation of a competent aircraft instrument manual demands a like degree of patience and skill, plus the ability to present technical facts in simple, easily understood layman's terms.

Aircraft Instruments, by O. E. Patton, amply fulfills the requirements of a modern aircraft instrument text. It discusses each instrument in its proper classification, and describes its design and construction in a way that enables the reader to clearly understand its purposes, functions and principles.

The book includes chapters on compasses, altimeters, rate-of-climb indicators, air and groundspeed indicators, timepieces, electrical indicating systems, gyroscopic instruments, temperature gages, oxygen regulating systems, tachometers and pumps. There are also chapters on pressure and suction gages, fuel-quantity and fuel-flow gages as well as instrument installation and illumination systems.

Beyond an understandable description of the instrument itself, the author gives the physical laws and basic principles applicable to each type of instrument. He has sought not only to explain what the instrument is but why it works, and much of his material is presented through drawings and illustrations. While the work has been prepared for students and instructors, it should prove valuable to the experienced pilot and mechanic as well.

Aircraft Instruments, by Orion Edward Patton; D. Van Nostrand Company, Inc., New York, 1941; 220 pages, $2.75.

CLOUDS, AIR and WIND JUST OUT!

$2.50

By ERIC SLOANE

This Primer of Flight Meteorology, containing an introduction by Sverre Pettersen, gives the story of clouds and weather by means of simple text, graphic charts and 16 of the author's beautiful cloudscapes in gravure—Size 9 x 12—80 pp., mostly illustrations. A perfect gift.

The DEVIN-ADAIR COMPANY · Publishers
23 East 26th St., New York

Imagery of Flight

Aeronautics has been fortunate in having a strong appeal to artists and famous writers. From legendary times, man's aspiration to fly has been expressed in poetry and prose. Excerpts have appeared in many historical works, but this book is the first attempt to treat this phase of flying with any completeness.

The author is a poet as well as a pilot and he is evidently thoroughly inspired with the beauty, the romance and the imagery of flight. He does not limit his quotations to poems, but includes some remarkably fine prose which is written with a poet's imagination. The author's introduction is remarkable for its brilliant style. He writes:

"Who has flown and not been struck by the annihilation of ugliness at even a few hundred feet? No remnant of planless poverty or obsolescence survives a short climb. Over a great city characteristic five-story roofs provide in uniform black the fine geometry of a gridiron. The wonder that light works on this formidable terrain depends on whether one is flying into or away from the sun. Flying into it, the impression is hard. Uniformity takes on an iron hue relieved only by such brilliancies as would resemble gongs or artillery fire if they could be heard. Of such are the rivers, whose collision with the setting sun is head on; the small bodies of water and the myriad tiny scintillations of pane-glass and windshield. But flying with the sun at one's back reverses the process, favoring everything with shadowed softness. Only a supreme act of intellect on such occasions can evoke the shapes of dumbbell tenements, mournful yards, irresponsible penthouses. 'A glaze is put over life. The leaping hare is caught in a marble panel.'"

Many persons regard aeronautics only as a science, a great industry or a vocation. This book will give these prosaic individuals an opportunity to enjoy the flights of fancy of some of those who view flying as an inspirational art.

The Poetry of Flight, an anthology edited by Selden Rodman; Duell, Sloan and Pearce, New York, 1941; 190 pages, $2.50.

Design Sketchbook

One of the reasons aviation has measured its growth and development in tremendous strides is found in the restless eagerness of its designers for never-ending improvement. Before one model is finished and flown, new and better ideas for the next are being worked out on the drafting boards of its designers.

The *Aircraft Design Sketchbook* has been compiled for those who are dreaming of the airplane of the future while working out the problems of today. According to its preface there has been but one purpose in view, to give to the designer a collection of ideas in sketch form which will stimulate his own creative and inventive mind. It offers a wealth of detail on how different design problems have been handled by others in the past.

The book consists of three parts, the first showing sub-assemblies and breakdowns, the second containing drawings of complete aircraft, and the third showing a series of miscellaneous sketches. Included in Part 1 are sections on wings, empennage, controls, landing gears, power plants, passenger appointments, and armament. Part 2 covers single engined, twin-engined and multi-engined military and commercial types.

Sketches for the most part are three dimensional line drawings of the cut-away type found in many popular aviation magazines. Those who refer to it are cautioned that to adopt an idea as shown, without improvement or modification, is to stand still or fall behind as far as design is concerned. The hope is also expressed that by proper use of the book, the airplanes of tomorrow will spend less time on the design and drafting boards of today.

In treatment the book consists of page after page of drawings with descriptive captions kept to a minimum.

Aircraft Design Sketch Book, compiled and published by the Lockheed Aircraft Corporation, Burbank, California, 1941; 130 pages, $3.00.

Photoelastic Stress Analysis

A comprehensive presentation of the photoelastic method for stress analysis based upon stress pattern and the isoclinics, this treatise is one of the most thorough works on the optical method of stress analysis ever presented. It is launched with a comprehensive review of stresses and strains at a point and a study of the principles of elasticity.

This is followed by a résumé of the optics necessary for photoelastic study, including an exposition of the transverse ether wave theory of light and the kinematics of simple harmonic motions, necessary for its understanding and its relation to polarized light.

One of the key chapters of the book is the one devoted to the statement and proof of the stress-optics law and the explanation of the theory and interpretation of photoelastic stress pattern. One of the highlights of the work is contained in the section dealing with isoclinics and stress trajectories. It is the fundamental theorem of stress trajectories which has a number of important applications in photoelasticity and is presented for the first time in this book.

The remainder of the book is devoted to the mathematics of the process, equipment and interpretation of stress patterns and the art of making reliable stress patterns with special emphasis on boundary visibility.

Photoelasticity, by Max Mark Frocht; John Wiley and Sons, Inc., New York, 1941; 411 pages, $6.00.

Model Airplane Construction

While a number of books have been published about model airplanes, either they have dealt with the building of several specific models, or have covered a great deal of ground about flying them especially in competition. In other words the majority have presupposed an elementary knowledge of building and flying model aircraft on the part of the reader.

There has been a need for a book which would take the newcomer through the very first steps of how to go about building and flying that all-important first model.

Flying Model Planes by Harry McDougall, takes the beginner through this phase of his model builder's training and experience. The book opens with a brief history of early pioneers and an introduction to model aircraft and competitions. Elemental factors in design are next treated together with problems in designing model aircraft for long flights. There are chapters on the construction of the fuselage, wings, tail assemblies and undercarriages, as well as accessories and fittings, covering the model, and flight adjustments. Instructions for building two types of model are given, and a glossary of model aeronautical terms is also included.

Although the author is British, apparently there are few differences in methods of construction or in design between elementary or beginners' models in Great Britain and the United States. The book is marked by a clear simplicity in treatment and is well illustrated.

Flying Model Planes, by Harry McDougall; Lutterworth Press, London, 1941; 160 pages, 6*s*.

Quiz Books for C.A.A. Examinations

Written for student, Private and Commercial pilots who are preparing for license examinations, these three booklets present, in question and answer form, all the material likely to be offered on written examinations for various grades of licenses. The subjects handled are the Civil Air Regulations, Aerial Navigation and Meteorology.

The work on the *Civil Air Regulations* contains the entire list of questions from which the flying instructor selects a typical 20 for a written examination given students before they solo, giving answers that are acceptable under the latest Civil Air Regulations. The remainder of this book is devoted to questions and answers on the C.A.R. for which pilots with higher ratings are responsible.

The booklet on *Aerial Navigation* contains, in its first six chapters, all the general material on elementary navigation up to simple radius of action problems, upon which Private Pilots are examined by C.A.A. inspectors. This includes the basis of navigation, general astronomy, and time study, the reading and interpretation of maps, instruments and their use, piloting and navigation by dead reckoning. The questions and answers for commercial pilots handle radio range flying and celestial navigation.

The work on *Meteorology* is also divided into the section for the private pilot's examination, and the remainder for the commercial pilot's written test. It covers general material for the various grades of licenses and includes all the answers to the questions in the C.A.B. No. 25, "Meteorology for Pilots."

Flying Questions, by Carlton L. Wheeler, Ithaca, N. Y., published by the author; **Civil Air Regulations,** 23 pages, $0.75, **Aerial Navigation,** 43 pages, $1.00, **Meteorology,** 41 pages, $1.00.

Book Notes

Our War in the Air, by L. E. O. Charlton; J. M. Dent and Sons Ltd., London, 1941; 59 pages, 1*s*.

Information and independent comment are succinctly set forth in this brief account of the air phase of Britain's war against the Axis.

Industrial Plastics, by Herbert R. Simonds; 2nd edition, Pitman Publishing Corporation, New York, 1941; 385 pages, $4.50.

A comprehensive, concise introduction to the field of industrial plastics, the second edition of this book includes treatment of wartime developments in plastics and their use as engineering materials, such as for airplanes and their parts, bomb fins, bullet-proof composite plates, submarine battery holders, machine gun carriers, cartridge shells, infantry gun stocks, etc.

Industrial Research Laboratories of the United States, compiled under the supervision of Callie Hull for the publishers; 7th edition, National Research Council, National Academy of Sciences, Washington, D. C., 1941; 372 pages, $3.50.

The seventh edition of this occasionally published directory contains a complete list of industrial laboratories and consulting research laboratories in this country. Indices provide classified lists of serial publications issued by industrial research laboratories, geographical distribution of laboratories, personnel index and a subject index to research activities.

The Reference Library of the Welding Research Council, Section 1, Classified Library Catalogue; The Institute of Welding, London, 1941; 134 pages, 2*s*.

A catalogue of the library services of The Institut of Welding. It covers the loan, photostat and information service, the library catalogue, publications of the Institute and a list of periodicals abstracted.

Stabilitaets- und Leistungsberechnungen fuer Flugzeuge, mit Anwendung auf den Praktischen Flugbetrieb (Stability and Performance Calculations of Airplanes, Applied to the Practical Operation of Aircraft), by Gerhard Otto; C. J. E. Volckmann Nachf. E. Wette, Berlin-Charlottenburg, 1937; 86 pages.

A stability and performance calculation manual containing formulas and tables essential for quick estimations.

The Stresses in Aeroplane Structures, by H. B. Howard; Pitman Publishing Corporation, New York, 1933; 264 pages.

A discussion of those portions of the theory of structures which are of particular interest to the aeronautical engineer and designer. The aerodynamics of structural design are not considered in detail; therefore each problem is approached on the supposition that the stresses are required to be found in a given structure under a given system of external loads.

Theory of Elastic Stability, by S. Timoshenko; McGraw-Hill Book Company, Inc., New York, 1936; 518 pages.

Theoretical and experimental investigation of the stability of such structural elements as bars, plates, and shells. Various methods of solution are presented.

Theory of Elasticity, by S. Timoshenko; McGraw-Hill Book Company, Inc., New York, 1934; 416 pages.

Fundamentals and practical application of the theory of elasticity, together with solution of various problems of practical importance. Approximate and experimental methods for the solution of both two and three-dimensional elasticity problems are given.

War Damage Compensation, by Maurice Share; George Newnes Limited, London, 1941; 94 pages, 1*s*.

An alphabetical guide to the contents and interpretation of the War Damage Act of 1941 in Britain.

Solid Scale Model Aircraft, by J. H. Elwell; The Harborough Publishing Company, Limited, Leicester, 1941; 96 pages, 3*s*.

A study of the building of solid airplane models, this "paperback" discusses the various details of this type of model construction and explains how it is done. Plans are included for solid models of the Boulton-Paul Defiant, Hawker Hurricane, Supermarine Spitfire and Heinkel He. 111K. Mk.Va airplanes.

The High-Speed Compression-Ignition Engine, by C. B. Dicksee; Interscience Publishers, Inc., New York, 1941; 331 pages, $4.50.

An exposé of the principles governing the operation of the various types of high-speed compression-ignition engine now being produced throughout the world and a discussion of the problems associated with these engines.

ABC of the RAF, Handbook for All Branches of the Air Force, by Sir John Hammerton; The Amalgamated Press, Ltd., London, 1941; 132 pages, 2*s*.

An up-to-date guide to the varied and numerous activities of the R.A.F., this book contains sections on the R.A.F. today, elements of flying, special training and equipment, and elements of air fighting. In the preface, Sir Charles Portal, chief of air staff, writes that the work is full of accurate information and will be especially useful to all those who hope themselves to enter the Service.

The Aerodrome, by Rex Warner; John Lane, London, 1941; 336 pages, 7*s*, 6*d*.

A novel set in the environs of an airdrome and its neighboring village, this story threads tenuous fingers through the lives and happenings of its characters, unravelling the destructive interplay of opposing forces affecting two generations—that of the air vice-marshal who would reshape the whole material of human life, and that of a youthful airman from the village, who discovers an acceptance of ordinary life too vast to be reshaped by any one will.

Descriptive Geometry, A. S. Levens and H. C. T. Eggers; Harper & Brothers, New York, 1941; 240 pages, $2.50.

A book designed to help students and engineers to develop a power to think in three dimensions, analyze problems of space, and then develop a sufficient technique to enable them to reduce problems to a flat sheet of two dimensions, or to direct others in so doing. The format of the text is such as to provide easy correlation with courses covering the fundamentals of engineering drawing and analytic geometry, the symbolic counterpart of this graphic subject.

Library Accessions

Vol de Nuit, by Antoine de Saint Exupery; Harper & Brothers, New York, 1939; 137 pages, $1.00.

A school edition of this novel by a noted French aviator and writer, with questionnaire and vocabulary.

Air Law; Outline and Guide to Law of Radio and Aeronautics, by Howard S. LeRoy; published by the author, Washington, 1935; 120 pages.

A survey of legislation, administration, and judicial and administrative decisions pertaining to radio, aeronautics, and air rights as related to realty.

Atlantic Clipper, by Ellen K. Donahue; Oxford University Press, New York, 1940; 63 pages, $.50.

The story of a young American boy who made his first trip to Europe on the Dixie Clipper during his summer vacation.

Auto, Schiff und Flugzeug—Ein Buch von Technik (Automobile, Ship and Airplane—A Book of Constructional Development and Adventures), by John Fuhlberg-Horst; Im Verlag Ullstein, Berlin, 1930; 195 pages.

High-lights in the evolution of land, marine and air transportation.

Ground Instructors' Course, by R. G. Willis; Weems System of Navigation, Annapolis, Maryland, 1940; 108 pages, $1.00.

Study material, questions, answers and supplementary notes on Civil Air Regulations, based on C.A.A. examinations for Ground Instructor rating in this subject.

Vibration Problems in Engineerng, by S. Timoshenko; D. Van Nostrand Company, Inc., New York, 1937; second edition, 470 pages, $5.50.

The fundamentals of the theory of vibration and their application to the solution of practical problems, with a chapter on the more important vibration recording instruments.

Winged Highway, by William Stephen Grooch; Longmans, Green and Co., New York, 1938; 250 pages, $2.50.

The experiences of a veteran pilot who pioneered in establishing South American and trans-Pacific airlines.

From the Industry

Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assured by the Aeronautical Review.

Civil Aeronautics Administration

The number of certificated pilots in the United States reached a total of 91,442 on October 1, more than doubling the 44,000 licensed pilots on record with the C.A.A. as of October 1, 1940. The bulk of the 107.8 per cent increase is accounted for by the C.A.A. pilot training program, which graduated over 31,000 new pilots during this period and currently has more than 8,000 trainees in elementary courses.

Classified by grade, there are 75,411 private pilots, 14,437 holding commercial or limited commercial certificates, and 1,594 licensed as airline transport pilots.

Civil aircraft holding C.A.A. certificates of airworthiness increased 55 per cent, from 15,200 on October 1, 1940, to 23,496 on October 1 of this year.

The increases have been most spectacular in the last two years, since the C.A.A. training program got under way. Between October 1, 1938, and October 1, 1939, the nation's roster of civilian pilots increased from 21,524 to 28,439, but in the following year it jumped to 44,000 and in the succeeding 12 months to 91,442.

The same has been true of aircraft, though to a lesser degree. On October 1, 1938, there were 10,091 certificated; a year later the total was 11,758. Then a rise to 15,200 took place in 1940, with this year's total mounting to 23,496.

The effect of the Civilian Pilot Training Program on aircraft construction for elementary and secondary flight training purposes is reflected sharply in figures on domestic civil airplane production.

During the first six months of 1941, a total of 3,775 airplanes for civilian use were produced by American manufacturers, an increase of 65 per cent over the figure of 2,289 for the corresponding six months of 1940.

Of the 3,775 total, 2,265 were the 1–2 place single-engine type of from 51–70 horsepower, and 1,113 were 71–100 hp., both of which are elementary training types.

In the single-engine 166–225 hp. category, which includes aircraft used in the C.P.T. secondary course, the production in the 1941 period was 105, against only 14 in 1940. Multi-engine output in this class rose from three in 1940 to 25 in 1941.

A tremendous advance to 16,194,000 miles flown per fatality in the pilot training program of the Civil Aeronautics Administration during the three months ended August 15 has been announced by Administrator Donald H. Connolly. It compares with 8,252,000 miles for the previous three months.

In the whole program prior to February 15, 1941, the figure was 4,500,000 miles flown per fatality. Between February 15 and May 15, this figure rose to 8,252,000 miles. Between May 15 and August 15, the figure rose to 16,194,000 miles.

From the beginning of the program back in the Spring of 1939 to August 15, 1941, the over-all figure is 6,400,000 miles flown per fatality.

A further improvement in the fatal accident rate in pilot training was also included in the announcement.

With 27,750 taking instruction in the Spring Session which ended in June, there were six accidents that involved fatalities, a ratio of one to 4,625 students. In the Summer Session, with 16,018 enrolled, there were two accidents involving fatalities, a ratio of one to 8,009 students. There were 436 accidents of all kinds in the Spring program and 68 in the Summer program, of which only eight involved injuries to personnel.

As a new group of 12,000 start into the Fall course of the C.A.A. pilot training program with the opening of school, the rates for their insurance have again been voluntarily lowered. This is the sixth time since the start of the program in 1939 that the insurance companies have voluntarily lowered their premium charges.

Rates for the $3,000 life and $1,000 hospitalization and accident insurance for trainees in the elementary course have been lowered from $7.20 to $7.00. Rates for students in the secondary course have come down from $9.60 to $9.00 for the same benefits.

Student pilots, before the C.A.A. program, paid $35 for $3,000 life insurance during their training period. When the program was started, the insurance companies set the rate at $20. After the first experimental group had been put through the C.A.A.-sponsored schools, the insurance companies made successive reductions first to $14, then to $10 and then to $9, and then to $7.20 for elementary students. These rates cover the student against accidents in ground transportation to and from the flying field.

National Aeronautic Association

A new regulation which combines and simplifies previous texts from four Federal departments has been approved for the clearance of aircraft leaving or entering the United States on flights between this country and other countries or outlying possessions. The filling out of only three forms is now required as compared to a dozen or more previously. This will greatly reduce the red tape involved at airports of entry as concerns air navigation, customs, health, and immigration requirements.

The rules were developed along the lines recommended by inter-American conferences in 1935 and 1937. The draft was begun by Dennis Mulligan, when he was Director of Air Commerce, and Albert E. Reitzel, Principal Attorney of the Immigration and Naturalization Service. The work was completed by Mr. Reitzel in cooperation with interested agencies of the Government and the principal airports of entry.

The regulations appear in part IV, Title 19, Code of Federal Regulations,

printed in the Federal Register on September 3rd. Copies of the Register are available at the Government Printing Office in Washington.

Air cargo is fully as important as passenger traffic since a delay in delivery of key parts or materials can hold up a long assembly line.

Mounting demand for air cargo service is shown in the recent report of the Air Express Division of the Railway Express Agency for the first six months of the year. Shipments increased 28 per cent, poundage 47 per cent, and gross revenue 41½ per cent over the first half of 1940. The rate of gain went up month by month.

Even more significant is the experience of Universal Air Freight which started acceptance of shipments at two cities for forwarding by air to 12 other cities. Although the company's operations started only a month ago, the demand already is so great that 75 other destination points are now being added for shipments accepted at New York, Detroit, and Cleveland.

It is now believed that within 3 months it will be necessary to accept air cargo for any destination the shipper may specify. Additional acceptance points are planned after a study of results of present service. Already it has been necessary to revise weight restrictions from 15 pounds to a maximum of 100 pounds.

Thus it appears that the principle of freight forwarding service as applied to air cargo is long overdue and that air freight operations will play an increasingly important part in expediting defense production.

Although Secretary of the Interior Harold L. Ickes, in a recent press conference looked with a slightly jaundiced eye on the use of gasoline for "joy riding" in private flying, there is no intimation of any shortage or curtailment in the supply of fuel for unscheduled flight operations.

Since the private pilots who put in flying time to hold and advance their ratings are not "joy riding" but are about the serious business of keeping themselves fit for participation in activities of great value to civil air defense, it is evident that the private flying fraternity need have no immediate fears that gasoline will be their bottleneck.

Mr. Ickes made it clear that he fully recognizes the importance of scheduled airlines operations and wishes the airlines to have enough gasoline to meet all their needs.

The new plan to treble the output of 100 octane gasoline, with the assistance of Federal Loan Administrator Jones, of course relates primarily to military aviation. But it is an assurance against future trouble in the civilian field.

Expensive fuels with the 100 octane rating are used largely for high-altitude and high-speed pursuit ships and interceptors. Commercial airplanes can operate on gas of 90 octane or so and private planes at a lower rating, as a general rule. To produce 100 octane gasoline, the first run of special crudes is necessary, plus blending agents. For the usual operations of private planes, ordinary gasoline produced by the cracking process can be raised to the proper octane rating by the addition of agents such as tetra-ethyl lead.

Thus, there is no reason to fear any adverse effect on private flying through a shortage of gasoline. A shortage of blending agents would cut down on the supply of gasoline suitable for private operations. But the Ickes plan calls for plant capacity sufficient to produce all such components of 100 octane gas, thus tending to prevent a shortage in other high-test gasolines through diversion of blending agents produced in present plants.

Officials of the Civilian Pilot Training Program have been keeping a close watch on the gasoline situation and feel that there is nothing in sight that gives any cause for alarm.

U.S. Army Air Forces

Increased quotas for the training of Aviation Cadets as navigators have resulted in a number of vacancies for eligible applicants for new classes to begin at three-week intervals after October 4, the War Department announced.

Navigators will be trained at the rate of 5,250 a year and to become qualified, candidates must complete thirty weeks of schooling. Fifteen weeks are spent in one of the Air Corps' three navigation schools located at Kelly Field, Texas; Mather Field, California, and Albany, Georgia, or at the civilian school operated under contract by Pan-American Airways at Miami, Florida.

Another ten weeks are spent in a reconnaissance school and the remaining five weeks are spent at a gunnery school.

While undergoing training as navigators, Aviation Cadets receive $75 per month and $1 a day ration allowance, the same as Aviation Cadets learning to fly. When a cadet completes his training, he is commissioned a Second Lieutenant in the Air Corps Reserve with the rating "Aircraft Observer" and receives flight pay.

While applicants for this training must meet the general requirements for appointment as pilot Aviation Cadet, the physical requirements are less rigid in so far as the requirements of visual acuity are concerned. Visual acuity of 20/40 in each eye correctible to 20/20 in both eyes is acceptable. Applicants must be unmarried citizens of the United States between the ages of twenty and twenty-six, inclusive, of good character, sound physique, and excellent health.

In considering applications, graduates of accredited colleges and universities who have received a degree in engineering receive first priority. Second priority is given to graduates of accredited colleges and universities who have had, as a minimum, mathematics to include Plane Geometry, College Algebra and Trigonometry. In this instance, preference is given to those whose mathematical work has included Analytical Geometry and Spherical Trigonometry. A third priority is given to those who have had two years of accredited college work and who have had the mathematics outlined in the second priority classification.

The training of four-engine aircraft crews for service with the Air Corps Ferrying Command will be undertaken this month by Transcontinental and Western Air, Inc., under a contract approved by the Hon. Robert P. Patterson, Under Secretary of War.

The scheduled course of instruction will be conducted at the civilian contract flying school operated by T.W.A. at Albuquerque, New Mexico. Under the contract the cost of instruction is not to exceed $599,760.

Five-man crews, consisting of a pilot, co-pilot, navigator, flight engineer and radio operator, chosen from the personnel of the Ferrying Command, will receive a month's training to qualify them for operating the big planes.

More than 10 crews will form the first class this month, with similar numbers to receive training each month thereafter until the completion of the training program under the contract in the spring of 1942.

From Nome to Cape Horn, a "language of the skies" is keeping pace with air defense of the Western Hemisphere. Words are taking wings—too fast to be English or Spanish or Portuguese any longer. They belong to every flying man in the Americas.

Skeptics should talk to the 16 Latin-American aviation officers finishing a "refresher course" with Uncle Sam at Randolph Field this week. Many of them speak English fluently. All of them agree that pilots' lingo beats an Airacobra across national boundaries.

Words from the French, such as "fuselage" and "ailerons," are everywhere used and understood. But so is that good old Anglo-Saxon word

"stall." By no means universal south of the border, "loop," "spin," and "taxi" are gaining ground. "Solo" comes straight from Spanish and means solo in any language.

"Overcast" is an important weather term you'll find far from its English-speaking home. And cloud names such as "nimbus" and "stratus" hover fleecily over the entire hemisphere.

Because they're briefer, English words seem to have the edge in this pan-American flying jargon. Yet three Mexican officers now at the "West Point of the Air" boast an exception—"Machete!" It's that knife used with such deadly success in tropical jungles. Terser, more accurate than our "Give 'er the gun," say the Mexicans.

Aluminum Company of America

The Aluminum Company of America announced that it is giving up its exclusive rights to its registered trademark "Alclad." This trademark, under which certain "duplex" aluminum materials broadly used in the aircraft and other defense industries have been sold for 14 years, is well known by aircraft, military, and naval designers.

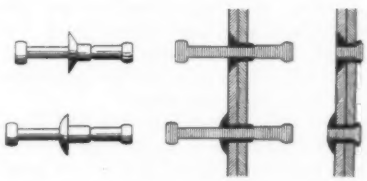
Other aluminum producers are now making similar duplex materials ultimately destined for Government use, and Aluminum Company of America recognizes the fact that the name "Alclad" is a convenient means of identifying such material as produced by others as well as its own products. Therefore, rather than make it necessary for these other producers to adopt their own trademarks, it was decided to relinquish the trademark "Alclad" for the use of the entire aluminum industry.

Cherry Rivet Company

A new approach to the solution of blind riveting problems is afforded to aircraft constructors in the form of the Cherry rivet which offers a method of cutting the time required for fastening components in places where only one side is revealed, making conventional riveting difficult.

The type of Cherry rivet being most widely used in aircraft manufacture is the self-plugging rivet which has a mandrel with an expanded section and head on the blind side. This expanded section is pulled into the hollow member, expands the shank and forms a tulip head in the back. This operation can be performed with either a hand operated or an automatic gun of which several designs are available. The outside end breaks off during application and can be trimmed flush with ordinary nippers. Aircraft factory tests show this type of rivet can be applied and trimmed at the rate of 540 an hour by one unskilled operator.

The outstanding feature of the Cherry Rivet is its positive mechanical action. When a pull of 300 to 900 pounds, depending on rivet size, has been exerted on the mandrel, there is little doubt as to the type of head formed on the blind side. The force required to apply the rivet breaks the mandrel and accomplishes two highly desirable results. It creates a clinching action, holding the sheets securely together. It also expands the shank of the rivet, causing a pressure fit of the shank. These last two features, according to the manufacturer, give the rivet strength and resistance to fatigue which compares very favorably with that of a conventional solid rivet.



Drawings of the self-plugging Cherry rivet assemblies in both brazier and countersunk types before and after the heading-up operation.

Curtiss-Wright Corporation

America's largest twin-engined airliner, the new 20-ton Curtiss transport designed for the airlines, but converted into a giant military cargo transport, has been accepted by the U.S. Army Air Forces after exhaustive flight tests and a large number of similar design will be produced by the Airplane Division of Curtiss-Wright Corporation in its Buffalo and St. Louis plants, it was announced by Burdette S. Wright, vice-president and general manager of that division.

Designated the Curtiss C-55 cargo-transport type by the Air Force, the prototype was originally designed and produced at the St. Louis plant of Curtiss-Wright Corporation to transport 36 passengers, a crew of five and 5,000 pounds of baggage and express at a speed of over $3\frac{1}{2}$ miles per minute at high altitudes. It has a wingspan of 108 feet, is 76.6 feet long, weighs 40,000 pounds fully loaded and is powered with two 1,700 hp. Wright Cyclone engines. The type to be produced in the future will be designated the Curtiss C-46.

The new Curtiss Transport was completed and flown for the first time last year. Combining huge carrying capacity and long range with the safety and economy of twin-engined operation, it was demonstrated to the Air Force and found to be well suited for cargo and troop transport operation. It was promptly converted from a commercial airliner into an Army Transport; the food galley became an ultra-modern navigation compartment; additional fuel tanks were installed to increase its already great operating range; numerous other changes were made.

During accelerated service tests recently at the Army base at Wright Field, Dayton, Ohio, the big transport flew more than 300 hours or approximately 66,000 miles in a period of six weeks. No recent information concerning its cargo troop-carrying capacity or its performance has been announced although the new transport—originally designed to carry 36 airline passengers in comfort—flew 933 miles from St. Louis to New York non-stop in four hours and 15 minutes cruising at only 60 per cent of its power, in May of this year.

Already a large producer of single-engined combat planes, the Curtiss-Wright Airplane Division will immediately prepare to manufacture the new twin-engined transport—to be designated the Curtiss C-46—in its three plants at Buffalo and St. Louis. At Buffalo, Curtiss P-40 pursuits and 0-52 Observation types for the Army, and Curtiss Kittyhawk fighters for Great Britain's R.A.F. are being produced, while at St. Louis, Curtiss SNC-1 advanced trainers for the Navy, and a new twin-engined trainer for the Army are being turned out.

In making the announcement, Mr. Wright said the organization had considered the possibility of building multi-engined aircraft of great size in planning and building its three new airplane plants at Buffalo, Columbus and St. Louis. As a result, he said, one section of the vast assembly area in the Buffalo plant alone has unobstructed space of $600' \times 200'$, with a 40-foot head room permitting the construction of any large airplane type now in operation or under construction; and 200-foot doors offering easy exit for the largest transport or bomber. The new St. Louis and Columbus plants are similarly designed.

The mechanical equipment now being used in producing small aircraft, Mr. Wright said, is easily adaptable to the sizes required to manufacture airplanes many times as large as those now in production. Unusually large presses will accommodate the over-sized parts of the Curtiss C-46 while special milling equipment will be used to produce the hundreds of machined parts. Even the shear equipment is capable of producing large sections of wing or fuselage skin up to 18 feet in length.

According to Mr. Wright, there is sufficient floor area for the assembly of cargo craft in the new Buffalo airport

plant without interrupting the flow of other production. One and 1/2 miles of overhead monorail system electrically operated will ease the handling of huge wings and fuselages and the high ceilings will permit easy movement of parts high above the assembly floor. Some of the work now under way in the assembly building will be moved to an underground section of the plant where five acres of area are available for productive work as soon as concrete floors have been laid.

E. I. du Pont De Nemours & Company

A transparent draft gage of "Lucite" methyl methacrylate resin is the newest of a line of indicators fabricated from this crystal-clear plastic by F. W. Dwyer Manufacturing Company of Chicago.

Transparency enables light to enter from three sides, providing high light visibility under all conditions. "Lucite," also, is light in weight, durable, and virtually unbreakable, and is easily machined into an indicator.

The new gage has been received enthusiastically by aeronautical, combustion and other engineers because it may be placed on a table, the floor or wherever convenient, and readings taken from above. Location of the scale directly below and close to the indicating tube eliminates the possibility of error from parallax.

The draft gage is leveled handily by means of an adjusting screw and a built-in leveling bubble. This bubble, set in a polished bore, is fully protected and visible from all angles.

Executone

A new system for plant and office communication of advanced technical design has been announced by Executone, Inc., of New York. The new equipment provides high power audio-communication for contacting up to 20 substations selectively or paging all stations at once.

Individual substations can be rigged to permit either private conversation or remote contact with the speaker several feet from the transmitting unit. Trumpet-type speakers with high sound levels are available for noisy locations in factories or for long-range coverage.

Besides the usual inter-office and plant communication, the Executone equipment may be applied to communication between members of assembly crews working inside aircraft. This eliminates the necessity for assemblymen getting out of the craft for personal directions or instructions to those outside, and does not have to be carried by the men inside as are conventional telephone transmitters and headsets.

Fairchild Engine & Airplane Corp.

The aircraft division of Fairchild Engine & Airplane Corp. now has some sixty women actually at work. Within a few months the number may run to several hundred. These women have proved themselves adept at all sorts of tasks except those requiring great muscular effort, such as the lifting or moving of large parts and subassemblies. They are doing riveting, sheet metal work, setting up work in jigs and many tasks involving the skilled use of light tools as well as the sewing, on fabric covers for control surfaces and upholstery, where it might be expected that they would be found.

Others are being prepared for the wood working department both for skilled hand finishing of wings for the Fairchild trainer and for the operation of woodworking machinery.

Not only former silk mill and shoe factory girls are doing well as riveters and machine tenders, but others from such occupations as school teaching and manicuring are making good in the Fairchild factory. Like the men they get enough skill to start as beginners at an average wage up to $26 a week after six-weeks courses in the municipal training school.

This ample and high grade labor supply has enabled Fairchild to keep well up with the heavy schedule of PT-19 Primary trainers for the Army and C.A.A. schools, for export, and with production of its familiar four-place cabin monoplane, the F-24, on large orders for personnel ferry service in the R.A.F. in England. It has also enabled the company to take large subcontracts from the Glenn L. Martin company in Baltimore for the control surfaces, wings and other parts that go into that company's famous bombers for the British and United States Army Air Corps.

Furthermore the availability of the women will enable the company to release its trained veterans for work on confidential projects for Army and Navy and to prepare for further extensions of its own orders and subcontracts. Though the women now employed run in ages from the teens to the fifties, those between twenty and thirty-three in age are found to be the best beginners.

A height of five feet three and a weight of around 125 pounds seem to meet the best physical requirements for the work involved. For the women who go into metal and machine work, suppleness and an ability to stay on their feet through an eight-hour shift are necessary. For other tasks such as sewing and machine tending less stress need be placed on these characteristics.

The men who work with these women are unsparing in their praise of the way they have learned and of the way they work. As the force increases it is planned to group the women together under their own forewomen and leading hands. At least two young women in the sheet metal department are already being specially trained for such promotion.

"And to say that women nowadays lack mechanical sense is pure anachronism," J. Carlton Ward, president of Fairchild said. "Even those whose 'place is in the home' live in a home full of mechanical gadgets from sewing machines to vacuum cleaners. They drive automobiles. They fly. They do these things well. There is no reason why our American women, with this superior mechanical experience generally, will not make even more valuable workers in the aircraft and engine industry than their sisters in England and France where neither men nor women generally have had the experience with gadgets that our people have had."

Firestone Tire & Rubber Co.

Further expanding its production facilities for the nation's all-out defense efforts, The Firestone Tire & Rubber Company is first in the industry to utilize tiremaking equipment and methods to step up output of an improved bullet-sealing fuel tank for airplanes.

By fabricating tank parts along its regular tire production lines and by introducing the use of curing molds for the first time, Firestone is eliminating three days of drying time, necessary under the previous method, and guaranteeing a permanent sealing of all parts of the tanks to withstand the heaviest machine gun fire.

In addition to the flow of production from the company's main plants in Akron, output daily is being increased at the Fall River, Mass., and at the Los Angeles, Calif., defense plants.

From these strategically located plants, airplane manufacturers are receiving prompt deliveries of fully molded bullet-sealing tanks without the delays caused by long hauls over the nation's overburdened transportation systems.

Fleetwings

A new hydraulic gun-charging valve that provides in a single unit the means of charging ten machine guns individually or simultaneously, has just been announced by Fleetwings, Inc., aircraft and aircraft parts manufacturers of Bristol, Pa.

Designed with an electrically ener-

gized automatic mechanism for returning the valve to neutral position, it represents a real boon to combat crews for it greatly simplifies the task of charging guns, making this operation faster and more efficient. Because it can take the place of ten separate hydraulic gun-charging valves, it reduces by 60 per cent the amount of tubing, connections, and fittings ordinarily required. It also reduces original assembly time and cost and lowers repair and maintenance expense.

The new valve, designated Type B-10-C consists of ten units but can be furnished for any desired number of guns. It weighs less than 16 pounds and requires only a simple one-half inch pull of the proper valve stem to operate the desired gun-charging cylinder. This valve stem remains latched in operating position until the gun is charged, at which time an automatic electric switch causes a solenoid to be energized, releasing a latch which allows the valve stem to return to neutral. When the piston is returned to neutral, the gun-charging cylinder is automatically connected with the return line to the reservoir. The valve stems can be pulled at will, separately or simultaneously, and as described above, will be returned electrically as their functions are completed. In case of electrical failure, each unit can be operated manually, without interference from the latching mechanism; *i.e.*, it can be returned to neutral merely by pushing the stem back to its stop.

The Type B-10-C valve, which is the latest addition to the large Fleetwings' hydraulic equipment line, will operate without seizure from lower than minus 40 degrees Fahrenheit to above 200 degrees Fahrenheit. Being fully balanced, it requires a minimum force, three to four pounds, to operate, over and above the force used in overcoming the centering spring. Normal operating pressure can be carried up to 1,500 pounds per square inch and test pressures are carried to 4,000 pounds per square inch.

In addition to the B-10-C unit, Fleetwings has developed another gun-charging valve that is similar to the B-10-C except that it is not equipped with a latching mechanism and solenoid release. In order to charge a gun with this valve, which is known as Type B-10-B, the valve piston must be pulled out manually, by a simple one-half inch movement, and held until the gun is charged. By releasing the piston a spring is permitted to return the valve to neutral and thus the gun-charging cylinder is automatically connected with the return to the reservoir. The standard B-10-B valve consists of ten units and weighs only 10 pounds. It can be furnished for any desired number of guns.

General Electric Company

A new capacitor-discharge control specially designed for use with stored energy type resistance-welding machines has been announced by the General Electric Company, Schenectady, N. Y. Stored-energy resistance welding is especially suitable for welding low-resistance alloys, such as aluminum used in aircraft fabrication.

In the capacitor-discharge method of resistance welding, electric energy is stored in the capacitors of the control by a charging circuit, and then rapidly released into the welding transformer, the resulting current producing the weld. The charging circuit then recharges the capacitors, and the operation is repeated.

The control cabinet contains up to 22 capacitors, any number of which can be used at one time. Two special tap switches select the number of capacitors desired in one-unit steps, each of 120 microfarads. By adjusting the voltage output of the control, and by selecting the number of capacitors, flexibility in welding is assured.

A special circuit which prevents operation of the welding machine if the capacitor voltage is less than 3 per cent of its preselected value reduces the possibility of insufficient energy to produce good welds. The charging circuit quickly and automatically charges the capacitors, to the preselected voltage regardless of the number used, thus allowing fast welding speed.

The control is contained in a compact steel floor-mounted enclosing case, 8 feet 8 inches high (over-all), 4 feet $3^1/_2$ inches wide, and 3 feet $4^1/_4$ inches deep. The front portion of the case is divided into three sections, housing the rectifier tubes and their control equipment, the control dials and voltmeters, and a sequence control panel and voltage adjusting potentiometer.

A blower is furnished in the case to resist dust infiltration. Lifting eyes permit the enclosure to be moved by means of a crane, and the bottom is so constructed that the case can be moved by rollers.

Several safety devices are furnished with this control. A discharge contactor discharges the capacity units remotely by means of a push button if necessary. A manually operated 3-phase circuit breaker protects the anode transformer in case of a short circuit. If any of the cabinet doors are opened, interlocks automatically discharge the capacitors through the discharge contactor. In addition, a discharge bar is mechanically operated to short out those capacitors which were in use at that time. The remaining capacitors are shorted by means of the special tap switch.

A tiny, 1,000-watt mercury lamp developed by General Electric for searchlights and television studios has been used to solve a vital problem of aviation—the daylight measurement of the height from the ground of clouds.

Maurice K. Laufer and Laurence K. Foskett of the National Bureau of Standards discovered that by projecting the light from one of the high intensity water-cooled quartz mercury lamps, and noting with a photoelectric eye the "splatter" of the light where it hits the cloud, that the altitude can be calculated by triangulation.

"During the daytime," they explain in the Journal of Research of the National Bureau of Standards, "dark overcast clouds at an elevation of 9,000 feet have been readily detected. For cumulus clouds illuminated by direct sunlight and having elevations up to 4,000 feet, the detection is positive."

The projector consists of the lamp located at the focus of a 24-inch parabolic mirror having a 10-inch focal length. The "electric eye" detector consists of a vacuum-type phototube placed immediately behind a diaphragm with a slit opening $^3/_{25}$ by $^{11}/_{16}$ inch located at the focus of an eight-inch plano-convex condensing lens.

The narrow beam from the 1,000-watt lamp is projected into the sky at a frequency of 120 flashes per second and the rays scatter when they hit the clouds. This light scattering is detected by the photoelectric eye located at a known distance from the lamp and adjusted for this flash frequency that will distinguish the beam from background atmospheric light.

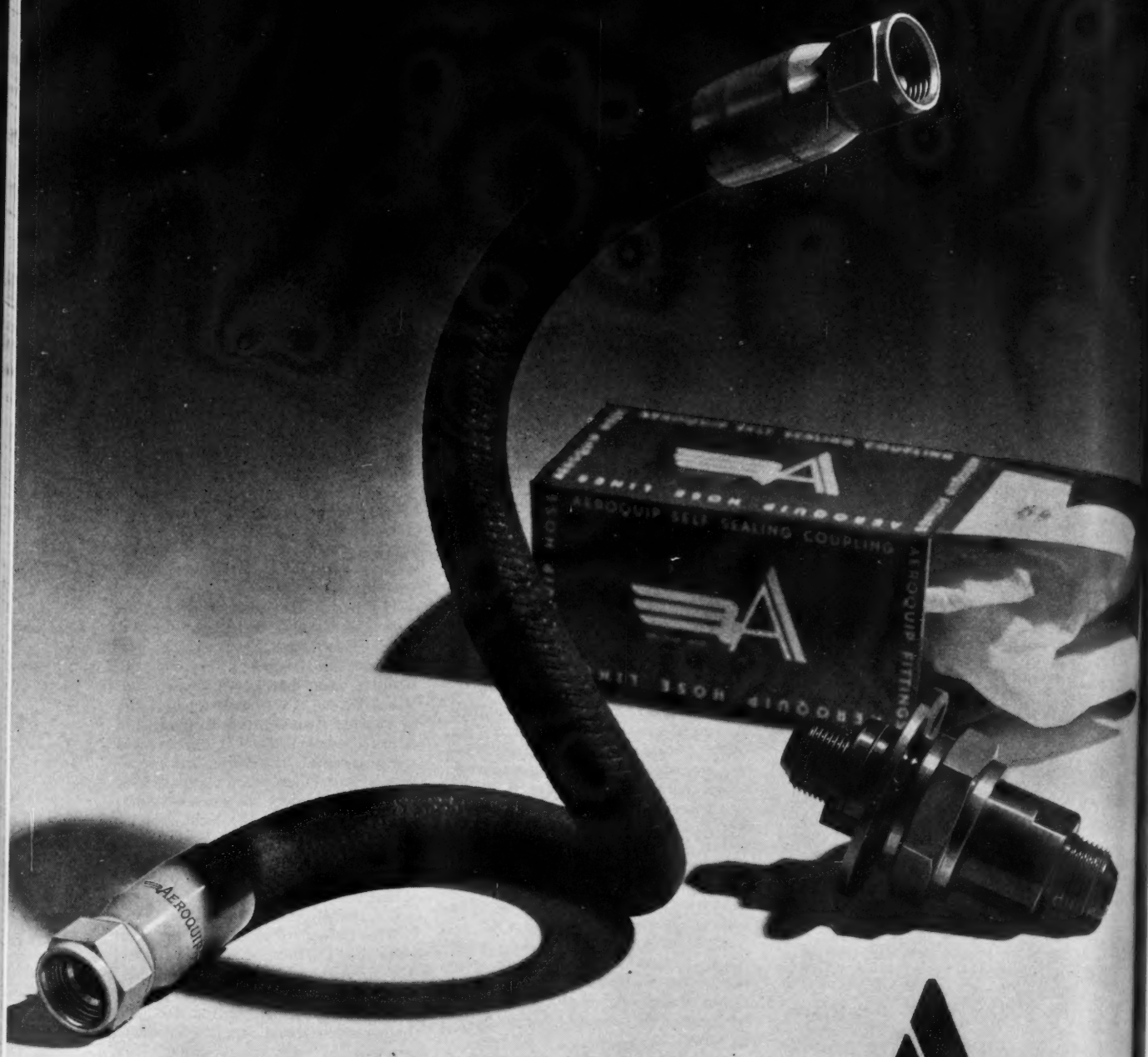
The cloud height then is determined by the solution of the right triangle formed by the line of the beam to the clouds, the angle of the electric eye sight upon the clouds and the base line connecting the beam projector and the phototube.

The Bureau of Standards scientists developed the method at the request of the United States Weather Bureau which at present employs small helium-filled captive balloons for the job. The balloons are reeled out like kites and observed through optical instruments. When the balloon disappears into the cloud, its height is estimated by the length of played-out line.

Sometimes these balloons are equipped with instruments for recording the temperature, pressure, and humidity at various altitudes. From these readings, cloud heights are calculated upon the basis of previous records and the result checked against the visual observation.

The quartz water-cooled lamps are the outgrowth of the search for a small light source of high brightness and efficiency and are possible because the industry now has available new glasses and sealing technique for quartz bulbs.

AEROQUIP HOSE LINES



AEROQUIP CORPORATION
JACKSON, MICHIGAN, U. S. A.

AEROQUIP SELF-SEALING COUPLINGS

General Motors Corporation AC Spark Plug Division

A material, chemically comparing to a semi-precious stone, and second in hardness only to the diamond, forms the insulator of a new spark plug now being mass-produced for the U.S. air forces and aviation engine manufacturers by the AC Spark Plug division of General Motors. Chief features of the new insulator are its resistance to harmful effects of lead in aviation gasoline, and its ability to withstand punishing heat and highest compressions. Tests have shown that the new spark plug lasts longer, thereby reducing the cost of plug maintenance and replacement and increasing the time that planes are available for use.

The present war brought out the necessity for a spark plug suitable for the higher output aviation engines, which have been developed for the larger type bombers capable of flying great distances with heavy loads of bombs and fuel under the most severe weather conditions.

The new aviation spark plug functions efficiently under all these conditions, and has been in actual production by the AC division for some time, with its entire output going to the United States government for use in bombers, fighting planes and tanks, and to commercial air lines for transport use.

AC research engineers spent some ten years perfecting the machinery and technique for manufacture of the plug. The basic material for the insulator is aluminum oxide. It is mixed with a binder and molded to shape under pressure and heat. Then, for a period of hours, it passes through a butane-gas-fired kiln hotter than any commercial tunnel kiln ever used before. When it emerges with the binder burned away, it is the stuff of sapphires, rubies, and Oriental amethysts, and will scratch any substance but the diamond.

The Goodyear Tire & Rubber Company

A new rubber derivative which can replace aluminum now used in the fuel tanks of airplanes and combat vehicles, providing greater protection against fuel leakage caused by bullet punctures or crashes, was announced by P. W. Litchfield, Chairman of the Board of The Goodyear Tire & Rubber Company.

The new product, which has been named Plioform, was developed in the company's research laboratories at Akron. Experimental fuel tanks made from this material have been carefully tested under machine gun fire. In announcing the new development, Mr. Litchfield gave out the following statement:

"In combat, a plane's fuel tanks are among its most vulnerable spots. If they are ripped by bullet fire and there is any substantial leakage of gasoline, the plane is likely to go down in flames.

"When the present emergency began, our chemists and engineers directed their efforts toward the development of self-sealing fuel tanks which would be superior to those then used by European nations. Linings of rubber were devised under new formulae to fit into the aluminum shells of these tanks and we were not long in attaining compounds which provided improved self-sealing qualities along with greater resistance to the action of gasoline on the linings.

"So far as these new linings were concerned, they would almost instantly seal the puncture of a fifty calibre machine gun bullet or a burst of such bullets.

"There was a remaining weakness in the fuel tank construction, however. Its outer shell was of aluminum and this metal flared when penetrated by heavy calibre bullets, particularly if the bullets 'tumbled' while passing through the tank. Occasionally the projecting splinters of metal would tend to hold open the punctures of the inner rubber lining.

"It was quite apparent to our engineers that vulnerability from this source could be reduced only by the perfection of a completely non-metal tank shell.

"That is how we developed this use for Plioform. It does not flare under gun fire and it will not burst under crash impact as metal tanks have been known to do. This crash protection is of especial value when such tanks are used in trainer planes.

Plioform tanks are adaptable for use on land vehicles such as scout cars and combat tanks, rendering them less vulnerable to enemy fire.

"Within a short time we expect to be in position to produce larger quantities of this material, thus providing the American fighting forces with superior equipment and eliminating one substantial drain upon the nation's supply of aluminum."

The method of processing this raw material is a military secret. Mr. Litchfield explained generally, however, that crude rubber is used in combination with a rubber resin to produce the new plastic.

Heat Elements

Heat Elements, Inc., of Buffalo announces developments in the manufacture of Black Heat, an element constructed by a novel process by which electric filaments of sub-glow temperature are interwoven with spun glass and other insulating materials on looms. The material is immune to short circuits by foreign objects and moisture, and is of greater thermal efficiency since the usable heat is produced without any of the energy being dissipated in unused light.

Important uses for aviation are forecast in the fabrication of Black Heat elements for the pre-heating of airplane engines, specifically in military use both for training and in combat, since this would effect a tremendous saving in fuel which is so important at this time. This will be done by the construction of a permanent or removable crankcase cover or oil reserve tank containing Black Heat elements to pre-heat the functioning parts without starting the engine, thus saving not only time and fuel, but preventing the fouling of spark plugs and the formation of carbon. Other airplane parts such as radio equipment, the gunner's turret, carburetors, intake manifolds, and superchargers can also be pre-heated or heated by the Black Heat elements.

The problem of de-icing airplane wings has been partially met by the use of a "rubber boot" on leading edges. Greater efficiency would obviously result by the addition of a heat unit. The new method of construction utilized by Black Heat promises greater efficiency since there is adequate insulation and at the same time the element is operated at a temperature much less than that developed in a luminous element.

Langley Aircraft Corporation

A new twin-engined airplane, built entirely of molded plastic-bonded plywood, received its first public demonstration recently at Roosevelt Field, Long Island.

The airplane was built by the recently formed Langley Aviation Corporation. It was designed by Martin Jensen, and built under the engineering direction of Arthur F. Draper, former Navy pilot, on an advanced process involving plastic formulas which seal under heat and air pressure various thicknesses of mahogany.

The Langley plane is a four-place craft, mounting two 65 hp. motors which give it a maximum speed of 142 m.p.h. and a cruising speed of 125 m.p.h. The ship takes off in 200 feet, and lands at 46 m.p.h. A second craft, now under construction at Port Washington, Long Island, will use two 90 hp. engines and will have a top speed of 165 m.p.h. and a cruising rate of 148 m.p.h. It will take off in 175 ft. and land at 48 m.p.h.

The molded plastic plywood parts of the Langley ship are multiple

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AVIATION ENGINES ...LARGE OR SMALL

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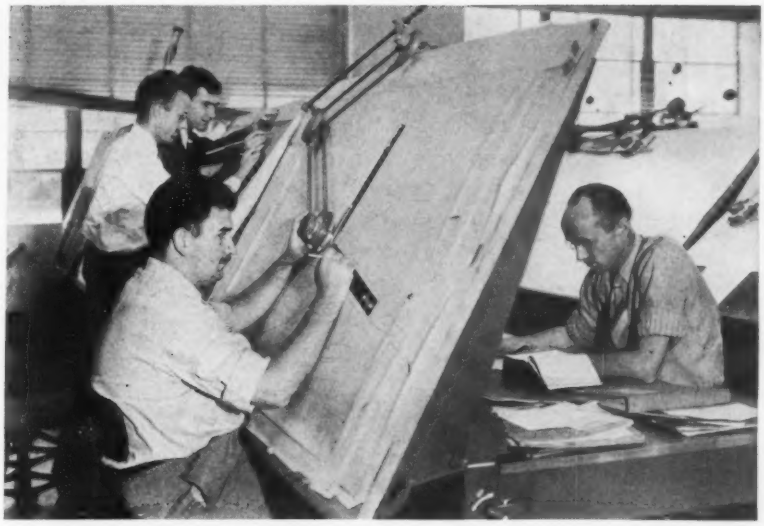
layers of veneer, formed over a mold and permanently bonded together into a completed structure by plastic compositions which react in their characteristic manner to heat and pressure. Each of the integral members—fuselage, wings, control surfaces and cowling—are joined without any mechanical fastenings such as nuts, bolts or screws. In place of mechanical dies, the Langley parts are made on relatively simple wooden forms or molds, prefabricated strips of veneer being placed over each other upon the forms while dry. On the mold, parts as big as half a fuselage are placed in a sack of rubberized fabric, each veneer layer being sealed with grains at right angles to each other in one hour or less in a heated pressure chamber.

Simplicity of construction, makes for ready inspection of the various units of the plane and cheaper maintenance and service. Each engine cowl, wing tip and even the entire nose is removable as a unit. The airplane consists of a very few sections, and the resultant relative absence of supporting members reduces the vulnerability of the ship as a target under gunfire. Cowls and fire walls are molded with an integral asbestos lining, although the plywood alone has shown itself in gasoline flame demonstrations to be much more resistant than aluminum. Plywood will not fatigue as metals do, and it is impervious to corrosion by acids, alkalis and salt water. The material has been tested without any signs of weakening in temperature extremes from 40° below zero to 160° above.

Materials required are available in unlimited quantities and are far removed from the priorities which govern many of the metals and other supplies used elsewhere in the aviation industry. The Langley craft is built from veneer strips ranging from $1/64$ to $1/8$ of an inch in thickness, the plastic composition and heat and pressure completing each airplane part. Only wood working machinery is required for manufacture.

Because of low cost of materials and a less expensive labor factor, price of the Langley is expected to be within moderate range particularly after the initial engineering and research expenses are written off. No specific price has been announced, although the builders state it will be much lower than that of any airplane of corresponding utility. Langley craft can be built as single or multi-engine ships and are expected to have application in almost every phase of aviation. Builders of the Langley see their molded aircraft process adaptable for military transport gliders, commercial or private airplanes or in larger sizes for commercial or troop-carrying transports.



A new type of drawing board, developed by the engineering department of the Glenn L. Martin Company, permits engineers and draftsmen to work while sitting rather than having to lean over flat drafting tables.

The Glenn L. Martin Company

A new type of engineering drafting board which cranks up and down like the window of an automobile is a development of the engineering department of The Glenn L. Martin Company in Baltimore. Thus taking a load off the feet and stomachs of the men who have spent most of their lives standing or leaning over tables, the new board now seats them comfortably in swivel chairs.

The development at Martin's was quite natural. The huge aircraft factories employ some 1,600 engineering employees who have suffered the discomforts of their profession, and now the 750 drafting tables in the engineering building, recently doubled in size, are being re-equipped with the device.

When not being used, the board lies flat on its desk-top. The draftsman, seated in his chair, twirls a small window-type crank which raises the board to the desired level. Then, by means of a horizontal bar, beneath the edge of the board, he adjusts it to the proper angle. The board is kept in firm position by a "dog," controlled by the bar, which drops into a notched locking sector.

This streamlined, comfortable table was developed by a group of engineers headed by H. G. Klemm, recently appointed Chief Engineer of the new Martin Plant at Omaha, Neb., which will start operations in the near future.

These tables are set in parallel rows so that the draftsman uses his own adjustable table for drawing and with but a half-turn of his chair has immediate use of the desk half of the combination table behind him.

Draftsmen, who for many years endured the strain of being on their feet all day at the old tables, like the new invention and contend that they accomplish a considerably greater amount of work and with noticeably less fatigue.

Another decided advantage of this tilted drawing surface is the greatly diminished amount of soiling due to perspiration and the rubbing in of pencil dust, etc., as the draftsman stretches and reaches across his work. This in itself is quite a time-saving factor as finished work requires so much less cleaning-up.

Metallizing Engineering Co.

The development of a new automatic metallizing machine which will eliminate many former hand operations in the spraying of aircraft cylinders was announced jointly by the U.S. Galvanizing & Plating Equipment Corporation and the Metallizing Engineering Co. of New York.

The new machine, recently installed at Pratt and Whitney, Wright Aeronautical Buick, Studebaker and other plants now working on airplane power plants is capable of spraying aluminum and other corrosion-resistant metals on air-cooled cylinders at the rate of 30 to 40 completed assemblies per hour.

The machine comprises six individual stations—each controlled by reducing gears and fully adjustable to various motions and speeds. Cylinders are loaded at Station No. 1 and then indexed to Stations Nos. 2, 3, 4, and 5, where metal coatings are automatically applied to different sections of the cylinder assembly. Station No. 6—the final step in the cycle—is for inspection and for unloading.

BECAUSE IT'S PAY-LOAD TIME THAT COUNTS

Like all transportation equipment that has to earn its keep, the commercial airplane's economic effectiveness is in direct proportion to the amount of time it is actually carrying pay-loads. Planes grounded for engine repairs or replacements bring in no revenues.

Aircraft engine makers are doing much these days to increase pay-load time by careful selection of the materials which go into their product.

It is for that reason that you will find Molybdenum steels used in so many engines for a wide variety of parts, ranging from cylinders to oil lines. These steels qualify on two essential counts: dependability and reasonable fabrication cost ratio.

Our technical book, "Molybdenum in Steel," contains complete data on steels for engine building. For detailed information on structural steels see "Molybdenum Steels in Aircraft Construction." Both these books are sent free on request to executives and production heads.

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MOLY

North American Aviation

J. S. Smithson, Works Manager of North American Aviation, Inc., announced the installation of an X-ray photo-template duplicating system in the firm's Inglewood plant which is believed superior to any template duplicating method now in use.

With the aid of an X-ray, North American will be able to duplicate any master pattern in the shop in an hour's time. This new method will save, in some cases, several days over the old manual reproduction method.

In addition to the regular metal templates, or master patterns, the process can reproduce the lines for Masonite dies used in forming sheet metal parts, and can duplicate the lines on wood jigs used with profiling machines. Since the process is a direct transfer, absolute accuracy in duplication is obtained.

When the aircraft industry began expanding at the outbreak of war, manufacturers began research on speedier ways to duplicate templates. With branch plants throughout the nation, the demand for copies increased tremendously.

Several companies turned to photography as the answer. By taking a picture of the original template and then enlarging it on metal to actual size, it was possible to make a duplicate by cutting along the photographic lines. However, a certain amount of shrinkage was involved in the enlarging process, and therefore the method was not foolproof.

With the cooperation of General Motors research men and the Eastman Kodak Company, North American has carried the process one step further. By eliminating expensive camera equipment, and substituting the X-ray machine, it has made possible a saving of thousands of dollars.

The process itself is a simple one. On metal sheets that have previously been treated with fluorescent lacquer, the loftsman scribes the template design. The effect of the lacquer is destroyed where he draws. He then sends the lay-out to the X-ray photo-template department, where it is placed under the X-ray. This causes the lacquered surface to glow. Since the lacquer's effect is destroyed where he has scribed, those lines remain dark. Then any practical surface coated on one side with film is placed next to the original template design, using a vacuum pressure arrangement to hold it firmly. When the afterglow of the scribed template reacts on the film, an opaque negative results. After the transfer process has been completed, the negative is developed by ordinary photographic means, and the finished product is ready to be cut, trimmed, and sent to the shop for production use. The system will produce either positive or negative prints.

Aside from the X-ray unit, the new photo-template department at North American is complete with dark-room, wash tanks, drying rack, and a chemical mixing room.

The low operating expenditure, coupled with the fact that North American is equipping its laboratory for around $6,000, will make it possible for the small manufacturer to install the same setup. North American believes that the initial cost will be returned in savings within three months. It is felt that the inauguration of this new precept in photo-template reproduction will be beneficial to all industries where templates are used.

Piper Aircraft Corporation

For the first time, regularly scheduled air-mail routes have been established with light plane equipment. The recent delivery of four Piper Cub Cruisers to the Dominican Republic signalized the opening of these new routes which will be watched closely by postal authorities interested in observing the adaptability of small airplanes for speeding mail deliveries.

The order for the four Cruisers was placed by Col. C. A. McLaughlin for the Dominican Republic. Colonel McLaughlin is a high ranking official of the Dominican Army and his choice of the Cruisers came after careful consideration of all types of planes available for such purposes.

While definite information as to exact routes flown by the Cruisers has not been available, it is understood that the ships will operate from limited airports in sections of the country where ground transportation is slow and uncertain. The ability to fly out of restricted fields with heavy loads made the Cruiser a natural choice for this service. The airplanes will be used exclusively for carrying mail which gives them an allowable cargo load of 340 pounds. Removal of the rear seats and installation of a cargo bin allows ample room for seven bulky packages. With 25-gallon gasoline capacity, the ships have sufficient reserve for extended hops, the range being in the neighborhood of 450 miles.

Presstite Engineering Company

Presstite Engineering Company, St. Louis, has announced the development of a new Fire Wall Sealer. Originally developed for, and now in use by, one of the country's largest manufacturers of military airplanes, this sealing compound is used in sealing the joint of the fire wall assembly separating the motor compartment from the pilot's compartment of military airplanes.

In liquid form, the compound is easily applied with a brush and it is claimed to set or dry to a tough, permanently flexible, resilient, rubber-like body. It is not affected by oil, gasoline, grease, or water. This sealer is used to prevent gases, fumes, oils, etc., getting from motor compartment into pilot's compartment.

Progressive Welder Company

Designed to increase productivity of resistance welding equipment in welding of aluminum and stainless steel, a line of refrigerating units for welding machines is announced by Progressive Welder Company, Detroit.

While intended still further to increase the productivity of Progressive aluminum and stainless steel welding machines, the refrigerating units (patents applied for) are available for other makes of welding machines in view of their potential importance in Defense for speeding and improving the welding of aircraft assemblies, etc.

Believed to be the first time "Refrigerated Welding" has been made commercially available, the unit makes possible continuous welding of four to ten times as many spots in aluminum without requiring point dressings.

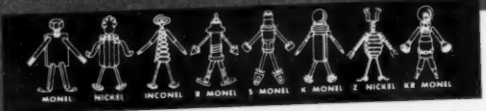
When used in combination with a spot-welding machine, the unit reduces electrode temperature to a point where—in spite of the high heat necessary to produce a weld—electrodes will be continuously covered with frost. This reduction in temperature has so increased point life that 10 minute runs, continuously, at 1000 welds per minute without point dressing are not unusual for the combination of a Progressive three-phase aluminum welder and the new refrigerating unit.

Primary function of the refrigeration is to keep the welding point cool at the point of contact. In resistance welding heat is generated at three primary resistance points, these being: (1) at the point of contact between the pieces being welded together, (2) at the point of contact between the "upper" piece and upper electrode, and (3) between the "lower" piece and the lower electrode.

Only the first of course is desirable, the other two tending to soften and permit deformation of the electrode tip—also producing pickup, by alloying of the tip with the material being welded.

Experimental production to date indicates a complete elimination of pick-up when the refrigerating unit is used, particularly on the Progressive aluminum and stainless steel welders, for

8 STRONG, RUSTLESS *Metals*



..each with a DIFFERENT PLUS!

Extra hardness, heat-resistance, non-magnetism, free-cutting and other qualities available in INCO Nickel Alloys

You doubtless know that Monel combines *strength* with excellent *resistance* to *corrosion.* But do you know that newer members of the INCO Nickel Alloy family combine varying degrees of strength with other useful properties? For example:

One of these metals is extra hard and non-galling; two are free-machining, two heat-treatable, one is non-magnetic, one especially adapted for high temperature service, while several make excellent spring materials for use under different conditions.

Knowing the *individual* characteristics of the INCO Nickel Alloys, will better enable you to meet the requirements of defense and other contracts. Write for the booklet, "*Individualized* INCO NICKEL ALLOYS." Address:

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	INDIVIDUALIZED CHARACTERISTICS	AVERAGE MECHANICAL PROPERTIES					
		Condition	Tensile Strength 1000 psi.	Yield Strength 1000 psi.	Elongation in 2 in. per cent	Hardness Brinell 3000 kg.	Impact Strength Izod
MONEL* 2/3 Nickel 1/3 Copper	GENERAL PURPOSE ALLOY Corrosion Resistance, Strength, Hardness, Toughness. Attractive Silvery White Color.	Annealed Hot-rolled Cold-drawn Cold-rolled, hard-temper	75 90 100 110	35 50 80 100	40 35 25 5	125 150 190 240	105 110 95
"R" MONEL* Contains the addition of .035% sulfur	FREE CUTTING For High Speed Machining.	Hot-rolled Cold-drawn	85 90	45 75	35 25	145 180	96 99
"K" MONEL* Contains the addition of 2.75% Aluminum	EXTRA STRENGTH AND HARDNESS comparable to heat treated alloy steel. Heat Treatable. Non-magnetic.	Hot-rolled: As-rolled Hot-rolled: Heat-treated Cold-drawn: As-drawn Cold-drawn: Heat-treated	100 150 115 155	45 110 85 115	40 25 25 20	160 280 210 290	120+ 40 56 26
"KR" MONEL*	FREE CUTTING Extra Strength and Hardness. Heat Treatable. Non-magnetic.	Hot-rolled: As-rolled Hot-rolled: Heat-treated Cold-drawn: As-drawn Cold-drawn: Heat-treated	105 150 115 155	65 105 85 115	40 25 25 25	185 280 215 290	
"S" MONEL* Contains the addition of 4% silicon	EXTRA HARDNESS Non-galling.	Sand-cast: Annealed Sand-cast: As-cast Sand-cast: Heat-treated	90 130 130	70 100 100	3 2 2	275 320 350	
NICKEL 99.4% Nickel	CORROSION RESISTANCE Protection for Pure Products. Magnetic below 680° F. Good Electrical Conductivity.	Annealed Hot-rolled Cold-drawn Cold-rolled, hard-temper	70 75 95 105	20 25 70 95	40 40 25 5	100 110 170 210	120+ 120+ 120+
"Z" NICKEL* 98% Nickel	EXTRA STRENGTH AND HARDNESS Heat Treatable. Excellent Spring Properties. Good Electrical Conductivity. Magnetic.	Hot-rolled: As-rolled Hot-rolled: Heat-treated Cold-drawn: As-drawn Cold-drawn: Heat-treated	105 170 120 175	50 130 90 135	35 15 25 15	180 320 220 340	120+ 25 120+ 25
INCONEL* 80% Nickel 14% Chrome Balance—Iron	HEAT RESISTANCE Retains Strength. Resists Oxidation. High Corrosion Resistance.	Annealed Hot-rolled Cold-drawn Cold-rolled, hard-temper	85 100 115 135	35 60 90 110	45 35 20 5	150 180 200 260	120+ 110 85

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MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL

Sheet...Strip...Rod...Tubing...Wire...Castings

which a new, harder and tougher tip material than generally available was developed some time ago. Retention of tip shape by preventing softening is also reflected in the maintenance of higher current density at the weld.

The unit can also be used for welding other types of material besides aluminum and stainless, and may also be applied to the cooling of industrial coolants, cutting oils, etc.

The new units are available in a range of three sizes, designed, respectively, for use with (1) a single aluminum welder, (2) two welders, and (3) a bank of four such welding machines. The units are provided with automatic thermostatic control, all standard safety appliances, built-in dehydrator, heat exchanger, external indicating thermometer, highest efficiency pump with variable pressure, etc.

Peculiarly enough, while the refrigerating unit absorbs a considerable amount of heat, experience indicates that welding machine settings are actually lower than when operating with water cooling. The lower setting of the heat control generally required is probably due in part to the higher conductivity of copper at the lower temperature.

Installation of the refrigerating unit is quite simple. Being self-contained, it is necessary in most cases only to disconnect the water lines to the electrodes and couple the refrigerator unit inlet and outlet connections to the electrode water piping.

Protective Coatings

A recent announcement from Detroit disclosed the establishment of Protective Coatings Incorporated which will manufacture a complete range of products for the preservation and protection of materials used in manufacturing.

This line is known as the Tocol line and their service includes complete rubber insulation as well as a line of more than 35 products for the protection of building structures, metals used in production and for the protection of many types of materials against the ravages of the elements—water, sun, acids, and alkalis—as well as general wear.

A non-oxidizing waterproofing material for concrete, stone, wood, brick and metals is one of the leaders in this line. Others are a metal conditioner for all metals; a coating that resists temperatures to 3,000°F., and used principally for refractory linings; and a coating which protects metals against all forms of corrosion.

Republic Aviation Corporation

Small and powerful magnets—which cost only a few dollars—save substantial sums of money and contribute greatly to the task of "keeping that line rolling" at Republic Aviation Corporation, Farmingdale, N. Y.

The magnets are used as "scrap catchers" to detect and remove any small tools, steel screws, scrap metal or other steel materials which accidentally are lost or misplaced within the airplane. They have been adapted for use by Harold Provo, Republic's hangar supervisor, and serve their purpose admirably.

For example, a few days ago a mechanic inadvertently dropped a small wrench into a supercharger duct, as a plane was about to take off on an important test hop. To remove the cowling and dismantle the duct in order that the tool be recaptured would have required about 16 hours work for a crew of several men. Instead, by dropping the magnet into the duct with a string attached, the tool was extracted in less than five minutes and the test went off on schedule.

The new Kollsman-Square D circuit breaker.

Similarly, the magnet is dragged through various ducts or fuselage interiors to remove any foreign material which may have collected there. After this is done, a powerful vacuum cleaner is turned on to suck out aluminum material which will not respond to the magnet.

Sinclair Refining Company

Top speed in safe servicing of air transport engines with oil is made possible by the Sinclair Aircraft Oil Truck, a new and original type of equipment in the aviation industry.

The Oil Truck is a specially designed streamlined unit with motorized equipment for oil draining and refilling. It is assigned to American Airlines at La Guardia Field.

The unit is low built so that it can operate inside a crowded hangar and maneuver about under the wings of airplanes. But there are many times when oil servicing is required directly on the apron in front of American Airlines hangars. The special unit can give this servicing from the most advantageous position directly under the nose of the planes. Approach can be made from the front where the driver has full view and can avoid all chance of damage to wings, propellers or other parts.

The unit consists of a Ford underslung chassis carrying one 300-gallon tank for new oil and one 250-gallon tank for drained oil. Motorized pumps permit simultaneous refilling of one engine and draining of the other engine of a Douglas DC-3 two-engine airplane. The operations can be performed by one man in about one-fourth of the time formerly taken by several men with old type facilities.

Hoses and nozzles from the new and drained oil tanks are mounted on retractable reels set in the front fenders. All pumps, meters and working apparatus are concealed but the operator is advised of the quantity of new oil delivered to the engine by a signal bell set for any specified number of gallons.

The tabulating meter is enclosed together with indicator dials showing amount of new oil and drained oil in the respective tanks.

Kollsman Division, Square D Company

A recent development of the Square D Company for circuit protection on aircraft is a new combination of circuit breaker and "on" and "off" switch. This new device, the Class 9300 Circuit Breaker, is available in a variety of ranges, including 10, 15, 20, 25, 35 and 50 amp. sizes.

All ranges are offered in the same small enclosure, sized $2^{1}/_{16}$ in. long by $1^{33}/_{64}$ in. deep and $^{3}/_{4}$ in. wide. This is the same as the standard "on" and "off" switch with which it is completely interchangeable. Mounting centers are $1^{13}/_{16}$ in. using $^{6}/_{32}$ in. self locking threads.

This compact circuit breaker saves space, weight and wiring time. It eliminates fuses and provides calibrated protection for each circuit, all within one sealed housing. For "on" and "off" the toggle lever is moved manually as with an ordinary switch. If dangerous overcurrent is present, the toggle lever snaps to the "off" position. To reset, merely return the lever to the "on" position. The 9300 Circuit Breaker is non-trip free (contact may be manually held closed for emergency) but when manually released, breaker will trip if overcurrent condition is still present.

The 9300 Breaker is approved by U. S. Air Corps, Wright Field, Dayton, Ohio, for all uses and by the Navy Department, Bureau of Aeronautics, Washington, D. C., for non-trip free requirements.

(*Continued on page 63*)

DADDY HASN'T SAID *Goodnight* IN AGES...

BILLY'S been slipping off with the Sandman before Daddy gets home these days.

Putting in 60 hours a week like Dad does making Kollsman Aircraft Instruments doesn't let a fellow get home too early.

But it's a big help to Uncle Sam.

Every hour of the 60 calls for skill. But you just can't turn out men as expert as Dad, overnight!

Sure, we've got as many skilled master craftsmen as we can find. And we're training promising young men and women as fast as possible.

They're *all* putting in plenty of overtime. But we realize that even the extra pay can't compensate for priceless hours spent at home with the wife and family.

For these personal sacrifices, this unselfish devotion to the nation's welfare, Kollsman . . . and America . . . are grateful.

ACHIEVEMENT

During the past two years Kollsman has increased personnel 322 per cent; instrument production 504 per cent. Production continues to increase, in keeping with the high standards of Kollsman precision.

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PRECISION AIRCRAFT INSTRUMENTS
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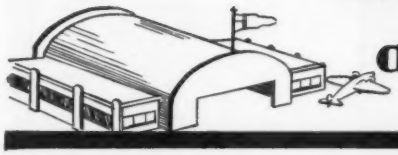
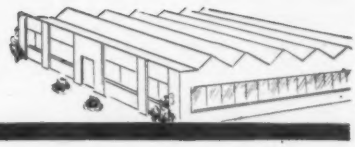




Plastics in Aircraft

Plastics Ply the Skyways. A history of the use of plastics in airplane construction, starting with the Pyralin windshields of World War days to the complex Lucite turrets and noses of modern bombers and transports and the resin bonded airplanes in modern production.

A diagram showing the location of plastic parts of modern aircraft is presented. *DuPont Plastics Bulletin No. 12.*

Synthetic Rubber Characteristics

A catalogue section on Ameripol D synthetic rubber and its uses in making mechanical rubber products has been issued by The B. F. Goodrich Company. Besides the usual description of physical properties, the section contains four tables which give enough general data on the material to answer most questions.

The first table compares the properties of Ameripol D with natural rubber and two other synthetics in 33 specific respects such as workability, adhesion and resistance to paint. The second lists the properties of Ameripol vulcanizing compound as to hardness, elongation, tensile strength, rebound, compression and abrasion resistance.

A third table gives the per cent volume increase after 48-hour immersion in water, alcohol, and typical petroleum products, while the fourth offers a rough guide to determining the services where the use of Ameripol D is practical.

American Swiss Files

Swiss Pattern Files of Precision. A 32-page catalogue of hand files, machine files and rifflers for die makers and metal workers. File patterns and cross-sections are illustrated and described. *American Swiss File & Tool Company.*

Vibration Control

A 20-page pamphlet under this title presents a study of the principles and application of vibration control throughout the use of rubber mountings. It explains that the isolation of vibration is dependent on the use of a mounting which is soft in the direction of the disturbing force.

The basic engineering principles of vibration isolation are outlined and typical case studies of isolation are provided. The Lord tube-form mounting which applies the principle of shear stressed rubber to two designs of vibration isolation mountings is described, and specifications for several sizes are given. *Lord Manufacturing Company.*

Women in Production

Lipsticks and Rivet Guns. In April of this year, Vultee Aircraft, hired fifty women as a production experiment. They were assigned to such tasks as electrical and radio assembly, drill press operation, minor structural assembly such as control and equipment installation and even light welding and riveting.

The experiment worked out so well that the number of women employed has been raised to 300. More work is being arranged for female help in case the supply of available male labor should be suddenly curtailed. A picture survey of women at various tasks in the Vultee plant is provided. *Vultair,* September.

New Turret Lathe

A descriptive booklet, issued by the Oster Manufacturing Co. of Cleveland, on their new No. 601 *Rapiduction* turret lathe. The new lathe is a simple, plain head, hand-operated screw machine, equipped with a hand feed to cross slide, and has a six station turret. The entire machine is thoroughly simplified, eliminating many features not used in the average turning, permitting the use of less highly skilled operators.

Plastic Trainer

Descriptive folder containing performance and specification data on the Timm Aeromold trainer, a two-place tandem low-wing monoplane, built entirely of plastic-bonded plywood. The primary advantages of the Aeromold construction are presented, along with general data on the trainer's dimensions, construction, power plant and standard equipment. *Timm Aircraft Corporation.*

Sales Engineer's Biography

"Trade Winds" Turns the Tables on Boedy, Candid Cameraman. A narration of the career of Kenneth J. Boedecker, sales engineer of the Wright Aeronautical Corporation, whose aviation career began with Lawrance and the ancestors of the present Wright engines. Among the famous engines he serviced were the Whirlwinds in Lindbergh's and Chamberlin's transatlantic airplanes of 1927. Sidelights on his hobbies and famed collection of personal photographs are also provided. *Trade Winds,* September.

Boeing 25th Anniversary

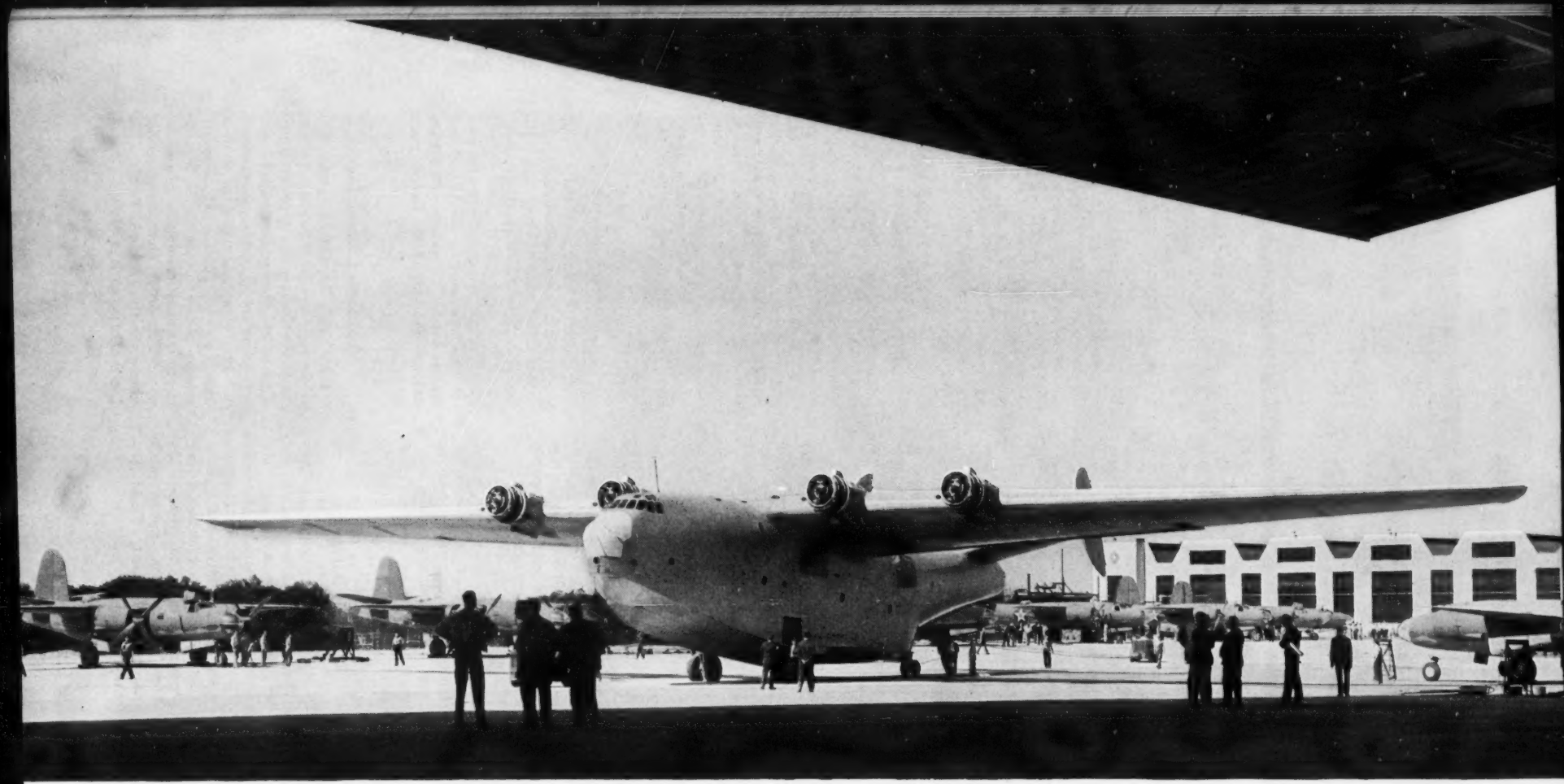
Commemorating a quarter of a century of aircraft building, Boeing Aircraft Company has issued a special booklet which presents the company history from 1916 to the present. The story of the company's beginning when William E. Boeing started to repair a damaged seaplane in 1916, how it branched out into building trainers, then transports and then fighters, is related. The company's progress is outlined. *Boeing Aircraft Company,* Seattle.

Fastener Catalogue

A general catalogue of the various types of fasteners manufactured by the United-Carr Fastener Corporation. Included in the listing are special fasteners for aircraft cowls and the conventional "Lift the Dot" fastener frequently used for attaching cowling, windshield and cockpit covers. Drawings, dimensions and specifications of the fasteners are furnished.

Accelerated Service Test

Uncle Sam's Bug Exterminators. The accelerated service test given by the Air Corps to every new type of military airplane is so planned that three of each new series are given the equivalent of one year of normal use in as short a time as possible. In this way, necessary changes and improvements can be made before quantity production gets under way. This article summarizes service tests given the Lockheed P-38's. *The Lockheed Aircraftsman,* July.



PREVIEW OF TOMORROW!

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Use of the Stroboscope

An explanation of the function and uses of the stroboscope, a device which permits a rotating or reciprocating object to be viewed intermittently, producing the optical effect of slowing down or stopping its motion. The device may be applied to speed measurement, and for analyzing high-speed operations as well as for photography at extremely high speeds.

In aircraft manufacture, the stroboscopic instrument has been used in engine and propeller research and by air lines for various tasks in maintenance. Another important use of stroboscopic instruments is for calibrating tachometers. *General Radio Company*, Cambridge, Mass.

Youth in Aviation

What Your Community Can Do for Its Youth in Aviation. A study of the necessity for guidance in aeronautical activity among the youth of the United States, made by Air Youth of America. A program for the sponsorship and direction of organizations interested in encouraging the study and the development of skill in aviation is offered. Who sponsoring persons or organizations may be, what the advantages of membership to the boys are, how the clubs may be organized and led, is explained. The brochure also presents a list of the services rendered to the individual clubs by the national Air Youth organization. *Air Youth of America*, New York.

Metallizing in Aircraft

Thin Skin. Pan American Airways maintenance department has, in a great measure, solved the problem of corrosion of engine parts and other steel equipment which are exposed to salt water, by the use of metallizing. This process, long used in building up worn machinery, calls for the physical spraying of metal onto the surface to be built up or protected. In the case of aircraft, aluminum is sprayed.

Besides cylinder barrels, which are the major problem, baffles, external oil lines, intake pipes, push rod housings, beaching gear wheels and fittings are also metallized for protection. *New Horizons*, September.

Fuel Line Accessories

Recently issued additions to the Aeroquip Corporation's looseleaf catalogue include folders on self-sealing couplings and special hose lines. The self-sealing couplings are designed for fuel and hydraulic lines to facilitate maintenance. Both the male and the female side are fitted with spring controlled valves which close when the union is unscrewed. This eliminates the necessity for draining-systems repairs.

Hose lines, and fittings to be attached to these couplings as well as the tools used to assemble them, are described in another folder. Specifications for both lines and fittings are also included. *Aeroquip Corporation*, Jackson, Mich.

Fabric and Tape Sampler

A catalogue of aircraft fabrics and tapes has been issued by Suncook Mills which incorporates actual samples of the various grades of material offered rather than describing them. General specifications and recommendations for use are provided. *Suncook Mills*, New York.

AMS Revisions

Additions and revisions to the Society of Automotive Engineers Aeronautical Material Specifications have been issued to holders of the A.M.S. series, covering, in new specifications, ignition cable markers, cast aluminum and magnesium alloys, brass tubing and rods, aluminum bronze rods and bars, copper silicon bronze seamless tubing and various types of bushings and bearings. Revisions included aluminum alloys, brass, phosphor and aluminum bronze, bronze castings, low carbon and deep drawing steel sheet and strip and music wire.

Plywood Data

A folder containing technical and physical property data on Fybr-Tech, a fiber-faced plywood consisting of a veneer or plywood core with sheets of vulcanized fiber of various thicknesses resin-glued to both faces.

Sizes, thicknesses, weights, also physical and mechanical properties, are listed and a weight and strength comparison between Fybr-Tech and aluminum is made. *Technical Ply-Woods*, Chicago.

Nut Catalogue

Standard sheet and price lists for various types of aircraft nuts made by the Boots Aircraft Nut Corp. of New Canaan, Conn. Full scale drawings, dimensions, weights and prices are given, as well as miscellaneous useful tables for the application of Boots products.

Lightplane Transmitter

Aircraft Transmitters. A descriptive folder on a new lightweight cross-country transmitter available for either dry or storage battery power supply. The transmitter operates on either 3,105 or 6,210 kcs. for ground or air operation and incorporates such features as a built-in loading coil, permeability tuned circuits and universal shock mountings. General technical data and three-view drawings are provided. *RCA Manufacturing Company, Inc.*

Plastic in Pursuit Airplanes

Airacobra Eyes. A study of how Plexiglas, the poly-methylmetha crylate plastic which is more transparent than glass and weighs only half as much, is cut, heated, molded and finished to act as windows in the cabin enclosures of the Bell Airacobra. *The Bellringer*, October.

Blower for Glider Training

"Wind Wagons" Train Glider Pilots. One of the new devices for training glider pilots is the Windcharger Wind Wagon, a motor-driven fan set on a truck. The propeller drives the air through a trough onto a glider which is suspended so that it can move freely in the airstream. Power is provided by the the truck's engine. *The Dragon*, September.

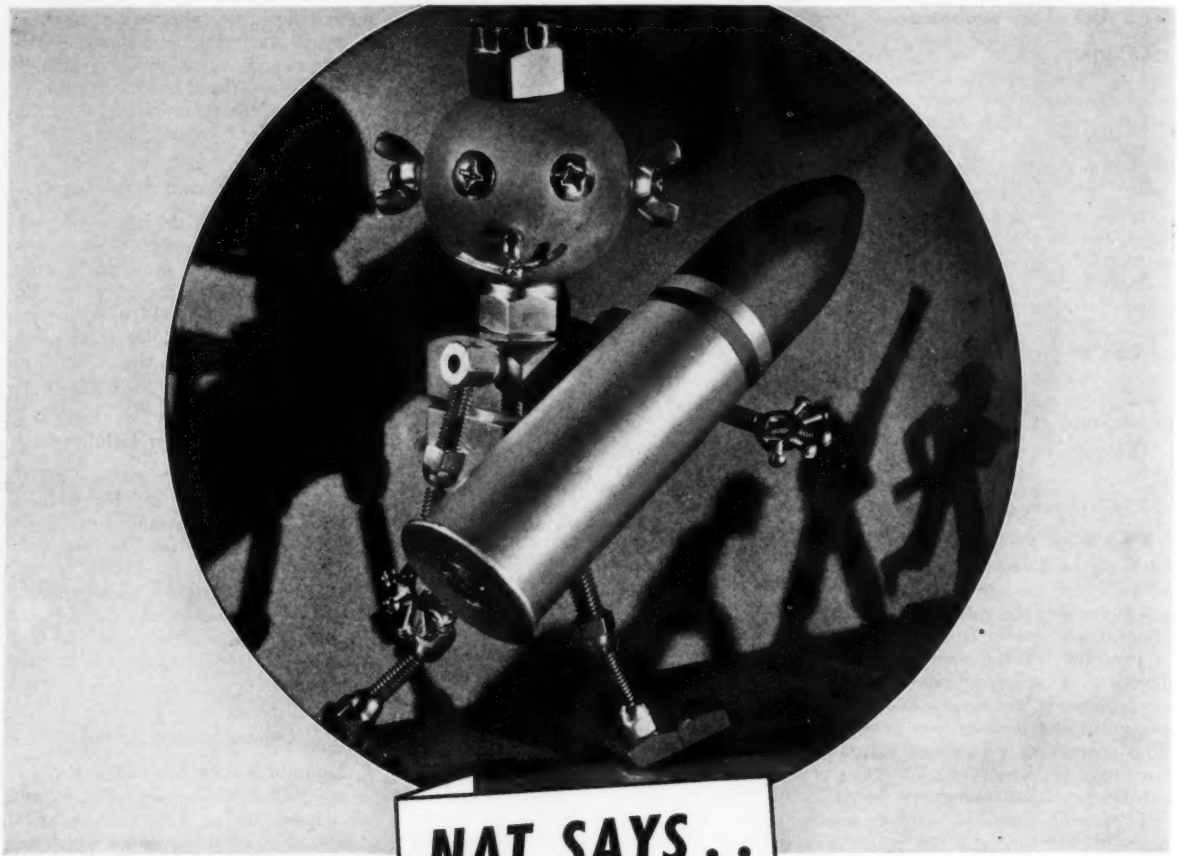
Engine Service School

Enlarged Wright Service School Keeps Users Posted on Engines. History and description of the Wright Aeronautical Corporation's Service School, which was founded 13 years ago to assure adequate training of mechanical personnel of the airlines, the armed services and other users of Wright engines. The course of study in overhaul and maintenance and line trouble-shooting is outlined as well as the general lectures on progress and improvements which are given twice a year in order to keep engineering, flight and maintenance personnel abreast with power plant progress. *Trade Winds*, September.

The Story of Beechcraft

On the Record. A 16-page booklet issued by the *Beech Aircraft Corporation* in an effort to minimize personnel turnover and increase efficiency through a program designed to acquaint employees with the objectives, policies, problems and future prospects of their company.

The booklet reviews the early history of the company and traces its progress from 1932, when the business was organized, through 1934, when production was first started in small quantities, up to the present. It is pointed out that the year-by-year growth of the company has been steady and conservative. Graphic illustrations show the consistent increase in number of employees from a total of 35 in 1934 to 3,320 as of May 1, 1941.



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Flight Instruments

A bibliography giving references for research in this specialized field. Revised and brought up-to-date from the fifty volume Bibliography of Aeronautics compiled and published with the cooperation of the Work Projects Administration from the Aeronautical Index of the I.Ae.S. This bibliography will be continued in the December issue.

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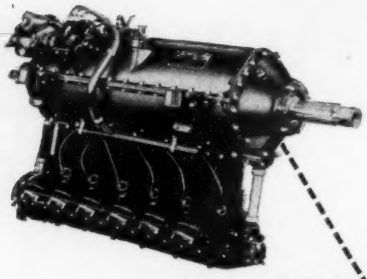

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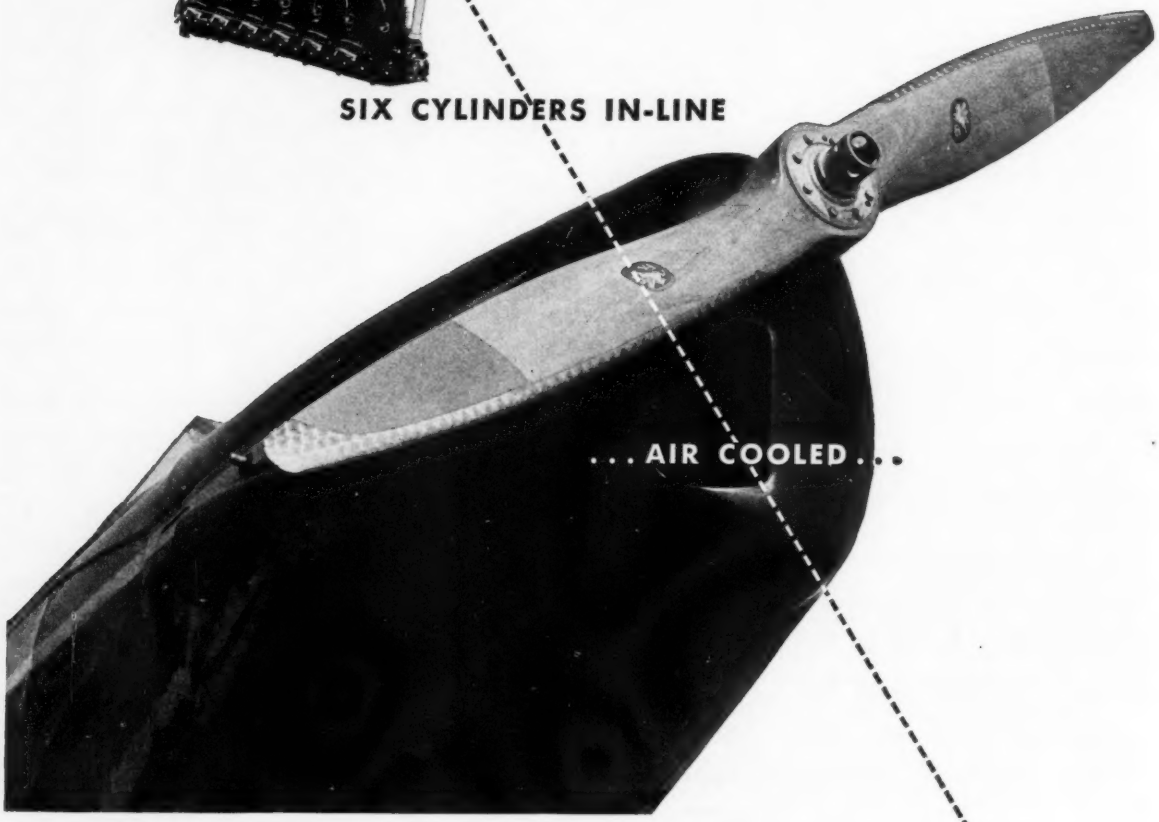

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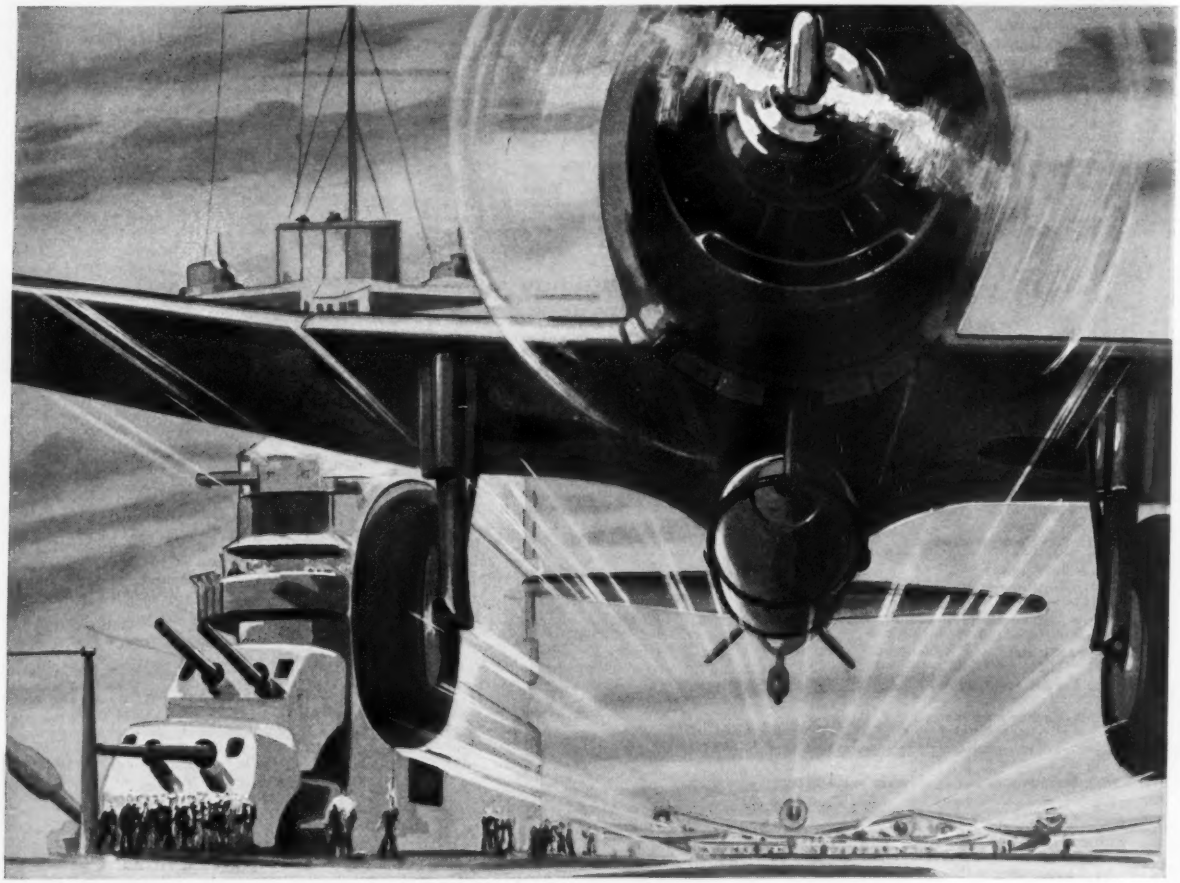

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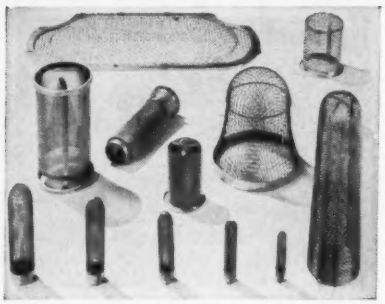

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Periodicals

(*Continued from page 24*)

cludes that the attempt to crack the morale of all three nations by bombing had failed utterly. Despite Germany's superiority in air strength at the beginning of the war, she has failed to damage over 2 per cent of the buildings in England or slow down her defensive production to any appreciable extent.

The summary covers the results of air effort in the low countries and the Mediterranean, as well as air phases of the blockade. The most recent move of the German war-machine, the campaign against Russia is analyzed. It is indicated that despite Berlin's claim two months ago that the Russian air force was shattered, that their equipment was hopelessly out of date and that their personnel was third-rate, the Red units still shoot down German aircraft and intermittently bomb German cities.

The observation is made that the Red military machine has superior morale which has proven itself capable of making up in many ways for mechanical deficiencies. The conclusion is drawn that Germany may win the Russian phase of the present struggle to the extent of establishing a stabilized line so that she can turn her attention to England. However, the cost of the Russian campaign will probably be so high that it may be the cause of Germany's eventual collapse. *Aero Digest*, October 1941, pages 50–52, 397–399, 3 illus.

Welding

Some Metallurgical Aspects of Metal-Arc Welding of Carbon and Alloy Steels. T. N. Armstrong. An analysis of metallurgical factors involved in the welding of various steels. The study is presented as an aid to changing conditions so that satisfactory welds may be made on steels which are generally considered to have poor weldability.

The phenomenon of metal-arc welding, the effect of carbon on weld hardness and other factors influencing the hardness of welds are described. The welding of high-tensile low-alloy steels and the effect of preheating on weld hardness are discussed. Also treated are the welding of high-strength S.A.E. alloy steels and the effect of adding 2 per cent nickel on weld hardness. *Mechanical Engineering*, August 1941, pages 585–590, 13 illus.

Wind Tunnels

Wind Tunnels. A review of some Continental wind tunnel installations designed by Dr. Ackeret, principal of the Swiss Federal Institute of Technology. His installation at Zurich is particularly described, since his other wind tunnel designs are largely based on this one. Notes are furnished on his more recent designs also. *Aircraft Production*, September 1941, pages 338, 339, 3 illus.

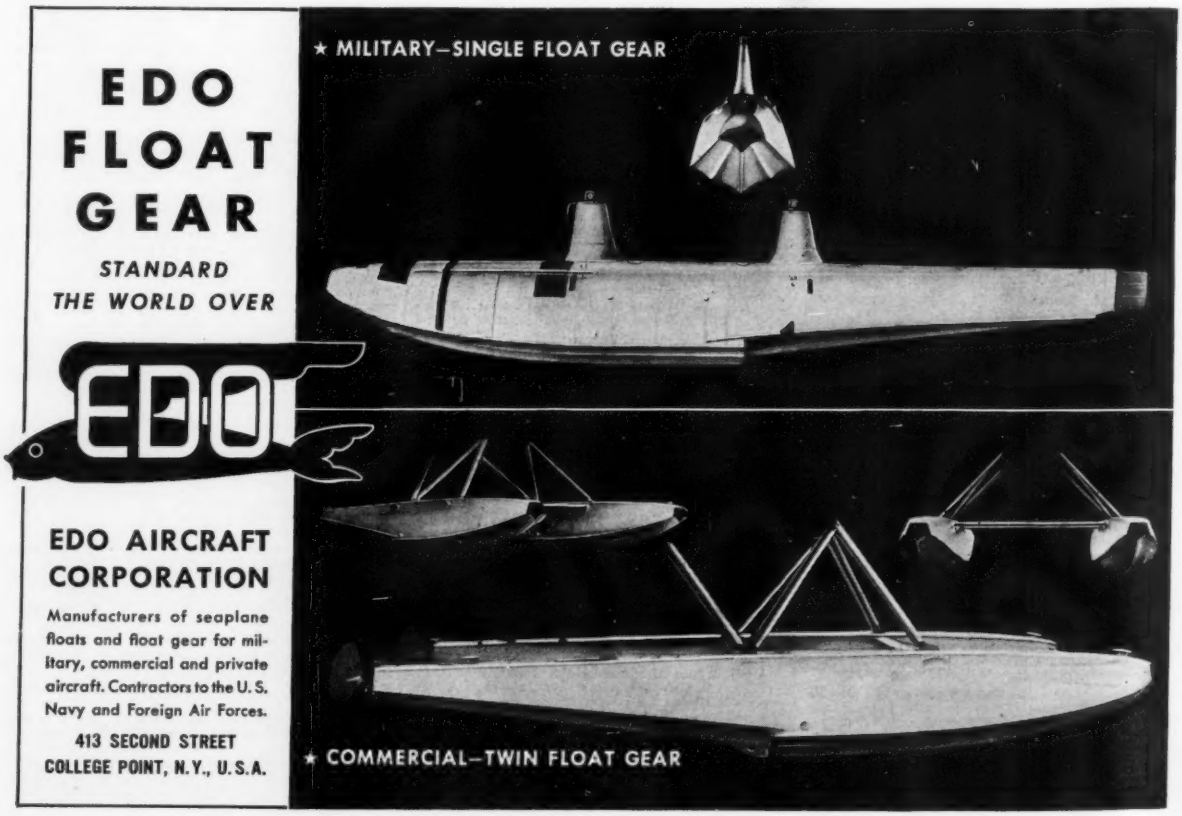
News Review

(*Continued from page 6*)

Takordi on the African Gold Coast to Para, Brazil, in 13 hours and 45 minutes—a distance of 3,400 miles.

October 8. The Supply Priorities and Allocation Board authorized manufacturers to accept orders on 228 transport type airplanes, specifying that they must be convertible into troop-carriers capable of accommodating a minimum of 28 fully armed soldiers in each.

October 8. A type of 115-octane fuel for aircraft, developed to increase power-plant performance, was announced to be ready for production by 1942.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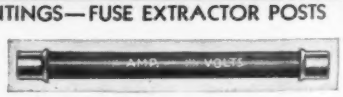

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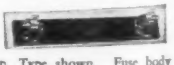

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From the Industry

(Continued from page 43)

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Vultee Aircraft

In the six months since Vultee Aircraft began hiring girls for actual shop work, women have worked shoulder to shoulder with men and proved their ability to handle efficiently a variety of jobs in practically all departments of the Company's California plant.

A total of 350 women now are on the shop payroll. Each is paid on the same wage scale as the men, with whom they work in such departments as Machine Shop, Sub-Assembly, Sheet Metal, Paint Shop, Power Plant, Inspection, and even on the Final Assembly Line. Their efficiency on the job indicates a greater share of direct production could be handled by women, should the national emergency result in sharp curtailment of the number of available men employees.

In fact, women are now in every manufacturing department at Vultee, except the Foundry and Hammer Shop, the Pattern Shop, and Center Wing Assembly Department.

In addition to this advantage, Vultee's program by that time had proved women workers could step up efficiency of the defense production of military aircraft.

The first 50 girls were given minor jobs at the California plant last April, freeing an equal number of men employees for more important tasks within the factory. Because of their known manual dexterity, the girls were put to work in electrical and radio subassembly, attaching wires and junction boxes where space is at a premium, and in the trim department, sewing fabric on ailerons, rudders and elevators.

The ability they exhibited to withstand successfully the routine of repetitive operations soon led to their being tried on various jobs throughout the plant, such as putting together small sub-assemblies, operating light rivet guns, drill presses, paint sprays and installing fittings and equipment in fuselages on the powered assembly line.

Women are now used on some 30 different types of direct production jobs, some of which reach into the upper brackets, such as aluminum welding, precision and Rockwell inspection and hand turret lathe operation. Men who formerly did these jobs were elevated to more responsible or more skilled positions.

Vultee Field has not stopped hiring men, but those hired begin immediately on work more suitable to them, leaving routine repetitive operations to women, whose efficiency on these jobs equals or exceeds that of men.

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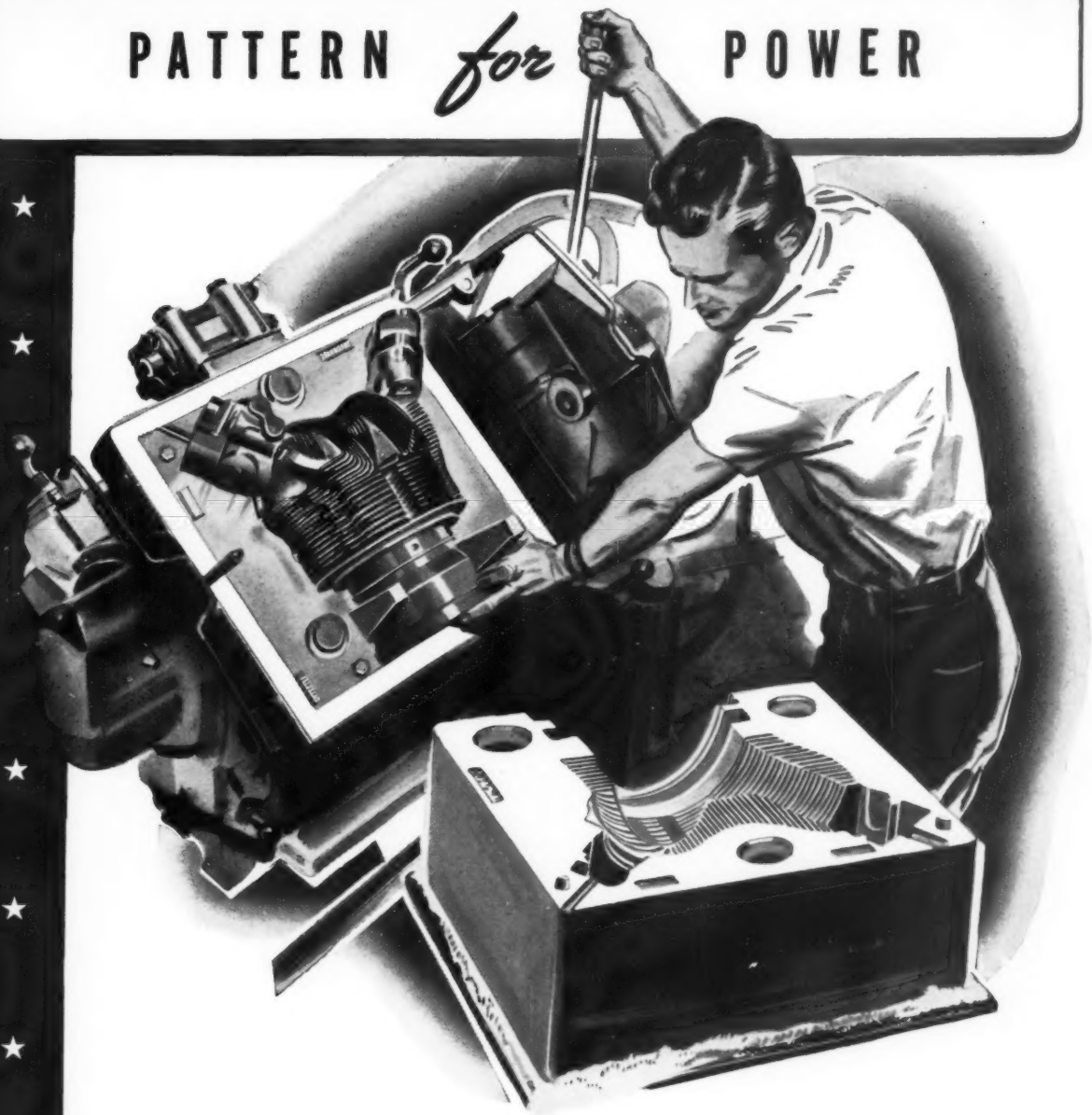
PATTERN *for* POWER



BEHIND the casting of a cylinder head for a Cyclone 9 lies a quarter of a century of painstaking foundry experience. Patient experiment with metals and sands has produced a technique for dissipating the roaring heat of explosions which create 1250 fifteen-ton power impulses a minute and make possible the 133 horsepower produced by each cylinder.

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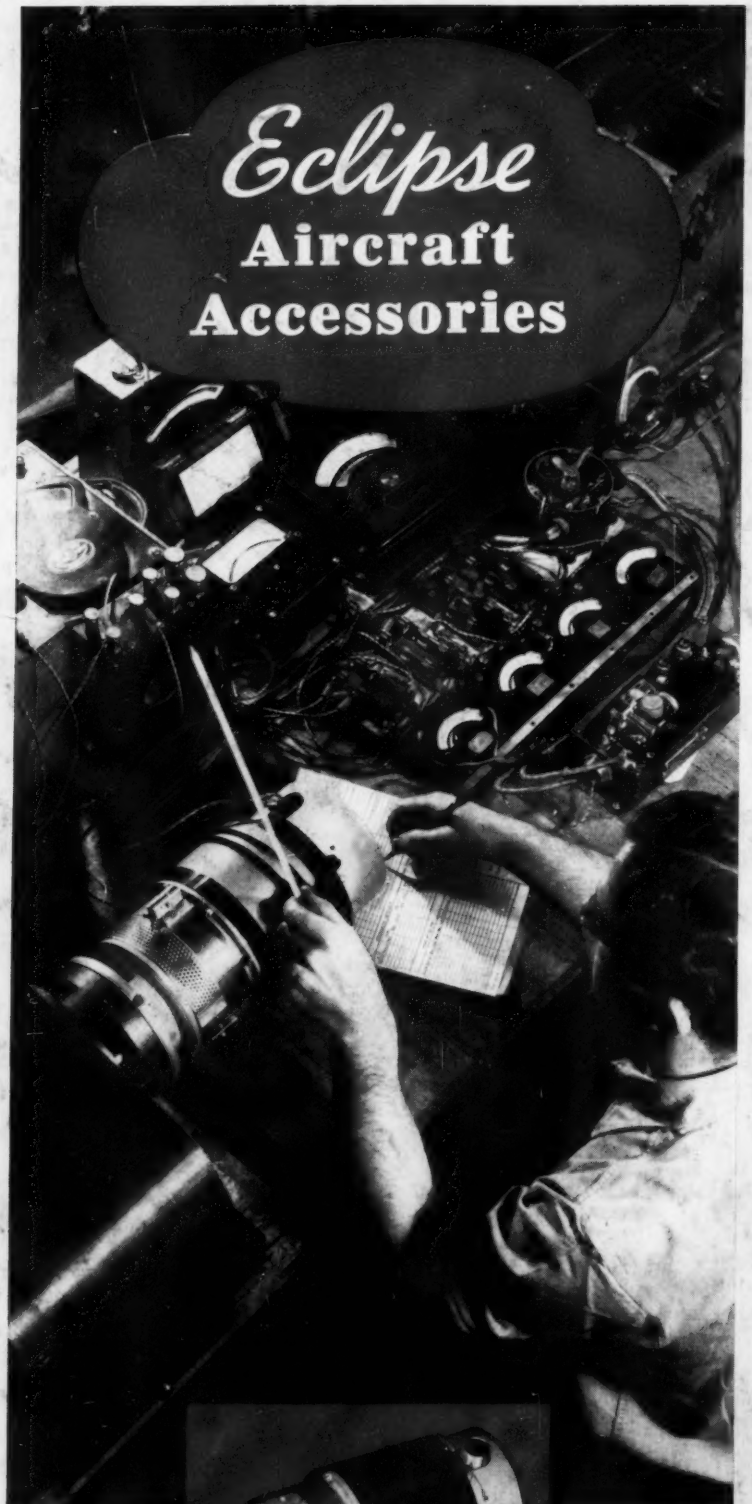
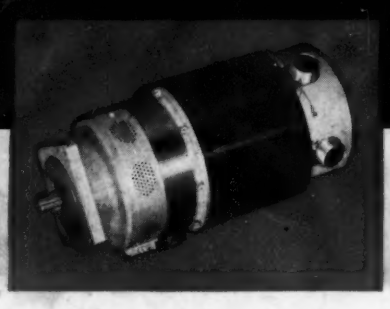


Above: Generator Performance Test—Eclipse Production Test Department



Left: Typical AC-DC Generator for Battery Charging and Radio Power Supply

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To maintain such standards, Eclipse Aviation has developed a production test department equipped with the most modern testing apparatus, supervised by specialized test engineers. Every assembled Eclipse unit is subjected to complete and searching performance tests conforming to rigid specifications of the Eclipse Engineering Department.

The continued selection of Eclipse equipment by the various aircraft manufacturers and military services is ample justification of the statement that *"For Dependable Operation It Pays To Fly Eclipse-Equipped."*

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